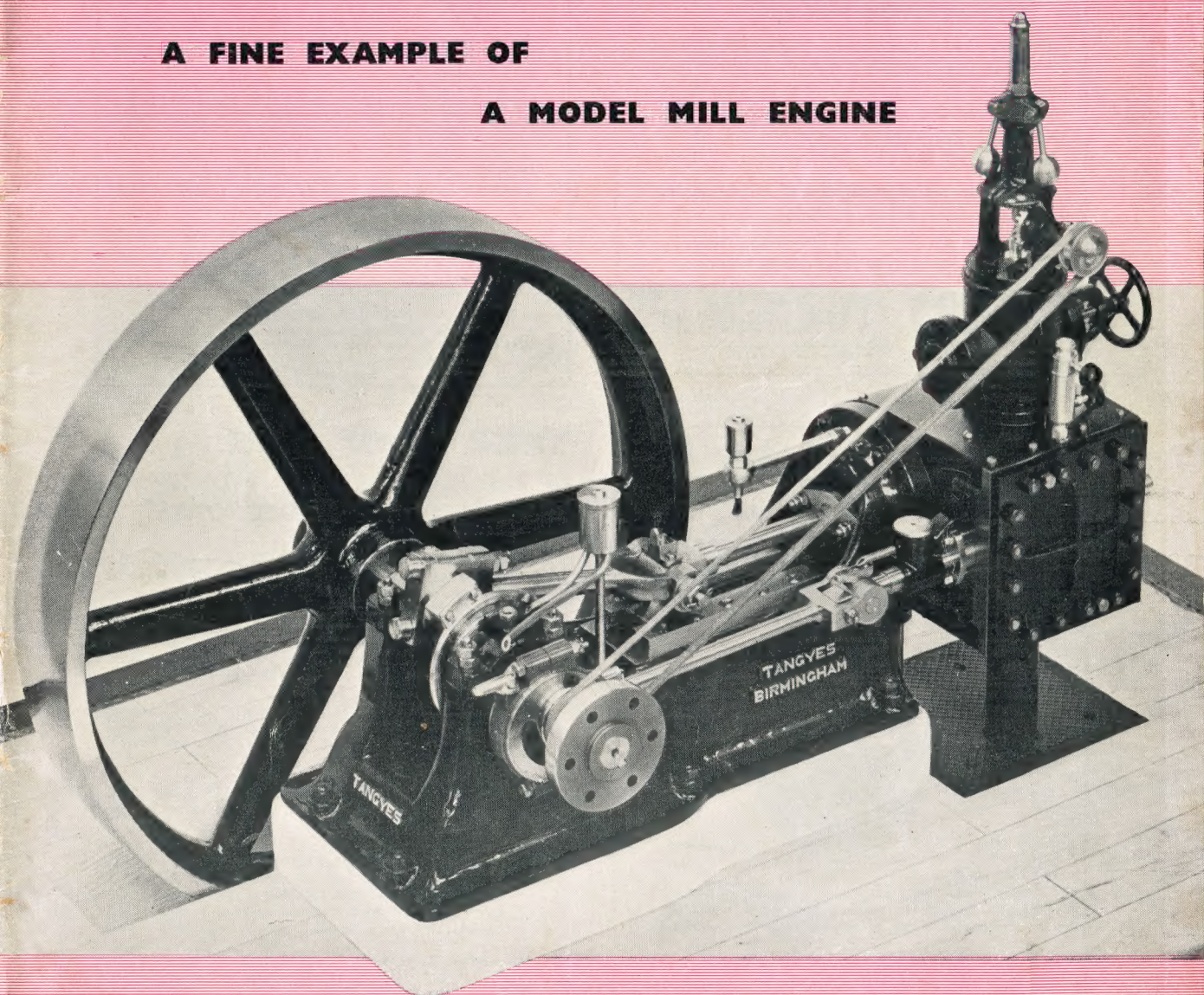


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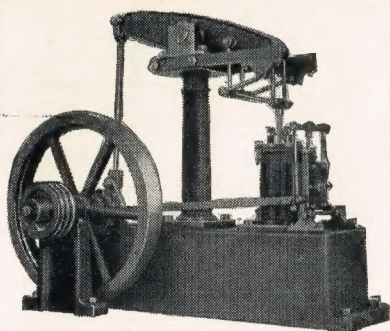
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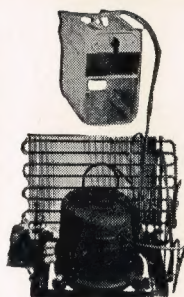
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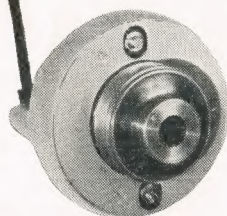
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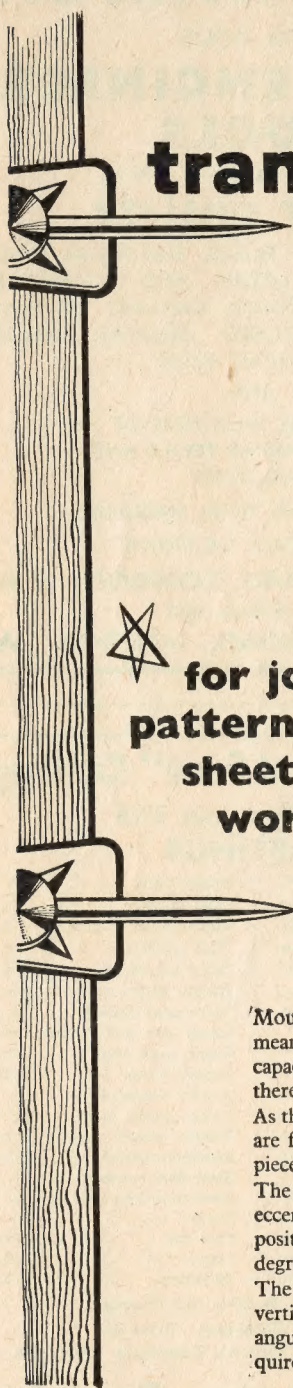
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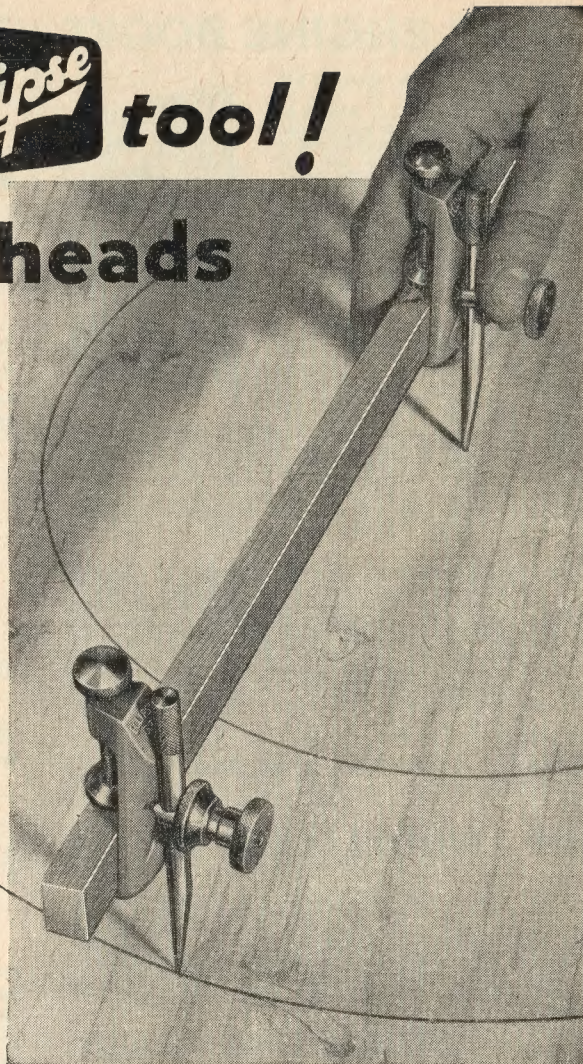
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workers**



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As the stiffness of the beam should be related to its length, the trammel heads are open sided and are fitted with a clamping screw of ample size in order that they can be secured firmly to any piece of wood of suitable thickness and of between $\frac{3}{4}$ " and $1\frac{1}{2}$ " width.

The points, which are hardened and ground, are secured to the body by means of a clamp and are eccentric, so that after the body has been clamped on the beam in approximately the correct position, final adjustment can be made by rotating the point before clamping it to the body; the degree of adjustment thus provided by each point is $\frac{1}{16}$ ".

The clamp which screws the point to the body can be swivelled and the body is grooved both vertically and at 45° , so that the point can be held with equal rigidity in either position—the angular setting being essential when marking under a ledge or similar obstruction. When required, a pencil can be used in place of the point.

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Model Engineer

24 JANUARY 1957

VOLUME 116

No 2905

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All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W.1.

SMOKE RINGS

A WEEKLY COMMENTARY BY VULCAN

AFTER long years in which the industry of this country has been regarded as inseparably connected with dirt, squalor and muddle, there are signs that it is beginning to tidy things up in many respects.

Quite apart from official legislation in respect of smoke abatement and health regulations many industries are voluntarily going to a great deal of trouble to avoid the production of dust and dirt, or the pollution of rivers by waste effluents. Many modern factories are clean and well ordered, both inside and out, though many of the older ones still leave much to be desired, and railway sidings could well be cleared of rusty scrap iron and debris.

Perhaps it is not too much to hope that some day the monstrous slag heaps which disfigure the industrial landscape will be removed. If, as may possibly happen, they are found to contain some hitherto unsuspected wealth, applicable to new processes, the incentive to dig them up again might be presented.

We are slowly but surely learning that neatness and efficiency in industry go hand in hand; the presence of a power station or a blast furnace need not necessarily spoil the beauty of natural scenery any more than does an ancient windmill or a ruined abbey. Industrialists in the past have often been too busy to worry about aesthetics, but modern labour-saving devices should logically bring about

a state of affairs in which everyone has more time, and perception, to appreciate natural beauty.

Let us hope that in due course the stigma of what William Blake described as "dark Satanic mills" will depart for ever from England's green and pleasant land.

Thoroughness

IN H.M.S. *Collingwood*, the famous naval training school at Portsmouth, so many boys are keen on model engineering that all of them cannot be accommodated on the work. Modelling occupies the three-week interval between the end of the course (marked by completion of the Admiralty test job) and the end of term.

Electrical artificer apprentices aged 17 and 18 have resumed the work begun by an earlier class on a synchro-clock intended to form the master timepiece for the administrative block of the establishment. Directed by Mr E. C. Fairclough, a civilian instructor, the boys undertake their modelling as a team, each of them making a part which must exactly fit another part made by a comrade.

Lieut A. T. W. Foss, R.N., Apprentices Workshop Officer, finds that model engineering fits the bill as a group activity which produces a result at the end. It is particularly valuable for teaching accuracy in teamwork.

Absolute thoroughness—a tradition

SMOKE RINGS . . .

in the Royal Navy—issues in work of an excellence which has been made known to the public through the Model Engineer Exhibition.

This is serious!

WHEN the B.B.C. Third Programme can solemnly announce a discourse on "The place of the potato in British folklore," it becomes increasingly difficult to distinguish between the "serious" and the intentionally comic.

The following passage reads like vintage Beachcomber but it was published as part of the day's news in a Sussex paper:

"Worthing Motor Club are thinking of running a petrol shortage rally. It would be exactly the same as a normal motor rally except that the cars would stay parked in the same place the whole time.

"Drivers would be given route instructions, would run out to their cars at one-minute intervals and then sit in them and work out where they would have gone had Nasser not taken over the Suez Canal."

Confronted with news reports like this, how can the professional humorist hope to compete?

Harnessing the sun

CURIOUSLY enough the old dream of harnessing the power of the sun seems to be becoming a reality just when science has discovered a vast new source of energy not in the tremendous firmament but in the unimaginably tiny atom.

The possibility of employing the sun as a direct source of domestic and industrial heat has now been lifted out of its Wellsian context and

given the solid framework of a scientific publication issued by Her Majesty's Stationery Office. In *Wind and Solar Energy* we may read the technical papers submitted by world experts to a symposium arranged by Unesco in New Delhi.

One of the contributors, Dr V. Baum of the Energy Institute in Moscow, describes a small solar energy plant which can produce more than five quarts of boiling water an hour, distil about the same amount of sea water in 24 hours, and cook a dinner for a family of five. On a sunny day it will do the work of a 600-watt electric stove.

Melt metal?

In this plant the sun's rays are concentrated by a concave mirror less than 4 ft in diameter. Larger and more precise installations, according to Dr Baum, could produce temperatures of as much as 3,000 deg. C. They would even be capable of melting metals.

Declaring that it is both wise and important to develop the use of solar energy wherever practicable, Professor B. Daniels of Wisconsin says that solar engines could be produced in small units at a low cost compared with the expenditure needed for hydro-electric plants or nuclear power reactors. Ideal opportunities for the employment of power from the sun are offered by the arid or partly arid expanses of the earth.

Already Indian scientists and engineers have developed a solar cooking stove which is manufactured commercially and may become as common in India as the electric hotplate in Britain and the U.S.A.

Nor is America ignoring this gift from the heavens. On the contrary, research proceeds there, as we have

Cover picture

The photograph shows a true scale model, by Kent and Tapper, of one of the most popular types of Tangye mill engine. We can supply working plans of simplified designs of horizontal steam engines including a Tangye type of mill engine.

seen from the contribution from Professor Daniels, and it is believed that within 20 years the United States will have about 13 million homes solar-heated.

Clock springs

SEVERAL readers have offered solutions to the spring problem which is hindering constructors of the M.E. musical clock, about which I wrote in December.

Mr W. Linfield, a Kensington reader, generously sent a small supply of $\frac{1}{2}$ in. \times 0.008 spring steel for distribution to those who cannot obtain the right material. I shall be glad to post a piece of this to the first 20 constructors who request it.

The specification by Mr Reeve is for $\frac{1}{2}$ in. spring steel of 0.009 thickness, but Mr Linfield thinks that the difference of one-thou will not adversely affect the working of the clock. It can be blued by heating in the usual manner.

This same reader also tells me that copper tube, brass, phosphor bronze and gunmetal rods may be obtained in small quantities and quite inexpensively from P. Wilkinson and Sons Ltd, of 14-19, Tottenham Mews, London, W.1. All supplies are sold by weight.

Kiddies' coach

A MINIATURE coach, only 7 ft long but fully operational, has been built by the apprentices of the Bahrein Petroleum Company.

The tiny vehicle, which can reach a speed of 20 m.p.h., is a semi-scale model of the Duple bodied Bedford coaches operated by the company. It is powered by a 150 c.c. Piaggio engine and equipped with four-speed gearbox and chain drive to one rear wheel.

Ackermann steering is fitted, connection between linkage and steering wheel being achieved through a steering box salvaged from an old Morris Minor.

The apprentices built the coach in their spare time, working under the supervision of an instructor, and a number of parts, including the front and rear axles, brake drums and the semi-elliptical springs, were machined in the company's workshops.

Apprentices of the Bahrein Petroleum Company riding in the tiny coach which they built. See "Kiddies' coach"





For enthusiasts of sail this model of the famous American frigate is fully recommended. B. G. PHILLIPS supplies the instructions, which will extend over five instalments

U.S.S. CONSTITUTION

THIRTY years ago, in MODEL ENGINEER of 1927, I read a description of a detailed sailing model of U.S.S. *Constitution* built by Col. F. W. Spicer of America. Later I read a book on the construction of a model of the ship and saw the photograph of the actual ship in *English Warships in the Days of Sail*. As a result I became attracted by the exceptionally fine rigging of this ship with its many interesting details.

Under full sail this frigate must have been a very beautiful sight. The height and spread of her spars and rigging was remarkable. She had single topsails, numerous stay sails, and was rigged for studding sails up to the topgallant. Some details of the sails have been included in the drawings, but I would not fit sails to a model unless it was to sail or the object was to produce a purely scenic model. The rigging itself in such a ship is too remarkable to be hidden by sails. A structure of such a size, constructed of timber and rope, able to withstand enormous stresses and yet capable of control by a few men dwarfed in size and strength by the height of the masts and extent of the yards and unassisted by any power-driven machinery, is in itself a thing of beauty and worth preserving by reproduction in a model.

One of three

In America considerable information is available in connection with what were known as the Federal Navy ships of the period, and *Constitution* is one of three of similar design. An Act of Congress in 1794 authorised the construction of six frigates, three of them being 44s.

There are difficulties in obtaining authentic data on this particular ship as she may have been at any one time. *President*, one of the three

heavy frigates, was captured by the English in 1815 and later broken up at Portsmouth, but not before drawings had been made of the ship as she then was. There are no such reliable records of *Constitution*, however, and there is more than one school of thought in America as to the exact details of the ship, although attempts have been made to reconstruct the ship and keep her alive as the English have done in the case of *Victory*.

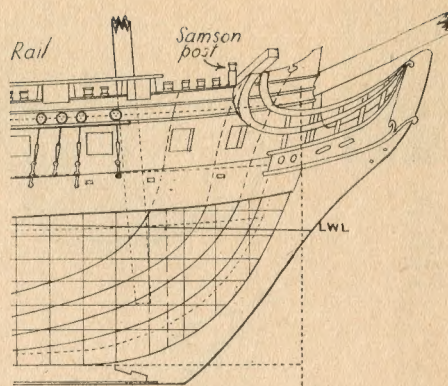
Uncertainty exists as to the designer and the source of the original draughts of the three frigates. The work is variously accredited to Joshua Humphrey, Josiah Fox and William Doughty, or to all three in collaboration.

Extensive repairs were carried out to *Constitution* between 1812 and 1815, and she was rebuilt in 1833, 1871-1877, 1906 and 1927-1930—but no records were kept of the changes. Further than this, when the hull was completed it was the practice for American captains to spar and rig the ships to suit their individual ideas.

Advantage for modeller

An original draught for the frigates of 1794 is shown on Sheet 1, with the various modifications to the hull giving the most probable appearance of *Constitution* during the early stages of her career, based largely on the known details of *President* in 1813-1815. In some ways this uncertainty may be an advantage to the modeller as a representative model may be built—and it would be difficult to prove any particular feature inaccurate provided it was in accordance with current practice during the active life of the ship.

Whatever may be the difficulties encountered in research *Constitution* makes a very pleasing model, representative of the large naval frigates built for the American Federal Navy at the end of the eighteenth century. It would appear that in America



Constitution fills a position similar to that of *Victory* in England.

Constitution, nicknamed "Old Ironsides," was launched on 21 October 1797, after some trouble with the launching ways, from Hartt's Shipyard at Boston, Massachusetts. The point where she was launched is now known as Constitution Wharf, opposite the junction of Hanover Street and Commercial Street, Boston. The man responsible for the construction of the hull was George Claighorne. The ship is still afloat and attempts have been made to restore her original appearance.

She was designed as a naval frigate of 44 guns; 1,576 tons burden; length is 175 ft between perpendiculars; moulded beam 43 ft 6 in.; depth in hold 14 ft 3 in.; height from keel to main truck 240 ft (see Sheet 1).

At the time the ship was laid down she was large for the frigate class; English 44s of the same period were some 20 ft shorter and French frigates 13 ft shorter. Details of the hull are shown on Sheet 2 and these are largely based on the measured information obtained from *President* in 1815.

The scale led to my first decision. I wanted the size of the model to be sufficient to display the spars and rigging to advantage, but not so big as to require too much "house room" and yet not so small that it would be impossible to reproduce many of the interesting details. Finally I decided upon a scale of 20 ft to 1 in. as producing a model of the best size both from appearance, overall dimensions and my own modelling abilities. At this scale the model is contained in a case 18 in. × 8 in. × 13 in. high.

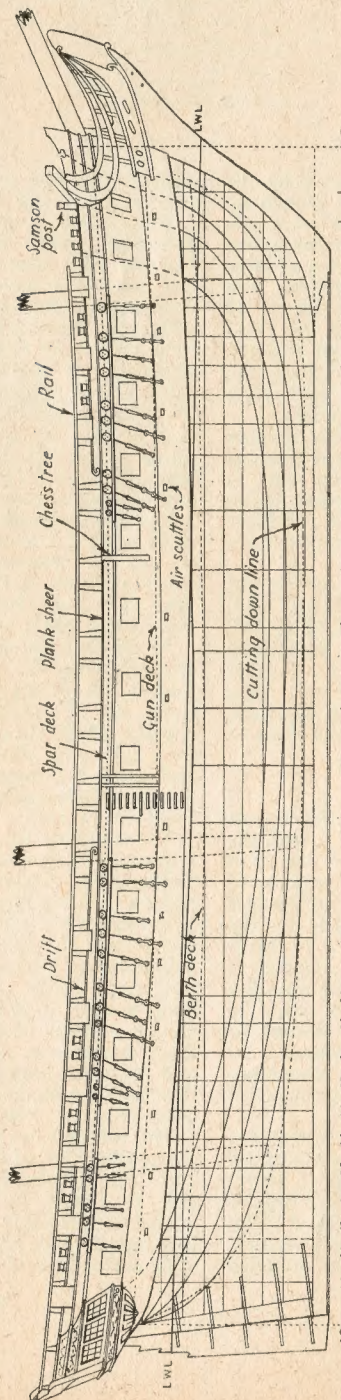
The details I am able to give from the construction of the model coupled with the information I have been able to obtain by research should enable a reasonably good representative model to be constructed to any scale normally used by ship modellers

ORIGINAL
ENSIGN.



BUILDING DRAUGHT

44 GUNS. 1576 TONS. LENGTH ON GUN DECK 174' 10 1/2". EXTREME BEAM 44' 2".



Some sections omitted

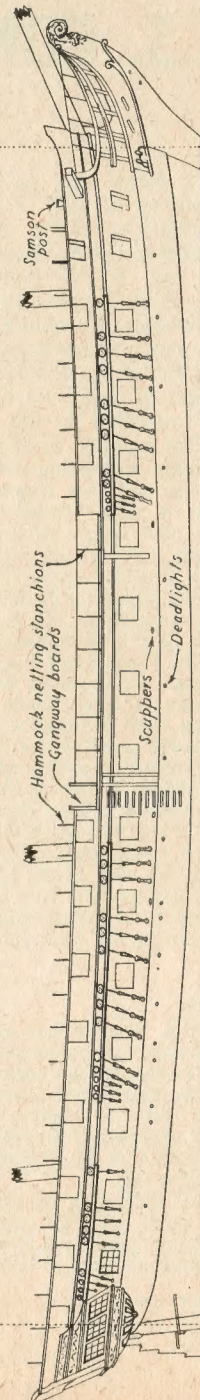
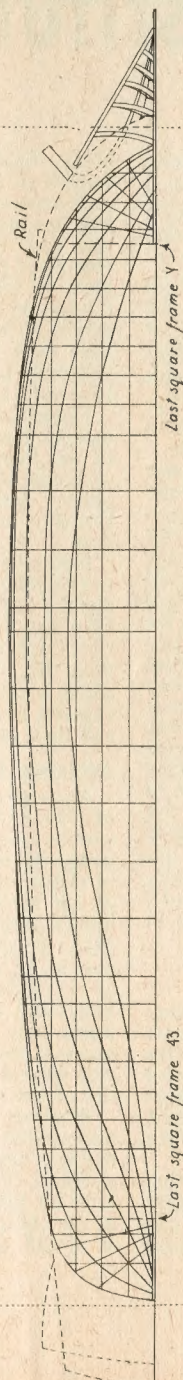
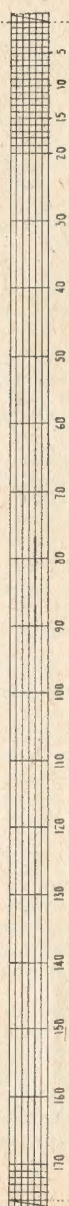
LOWEST WATERLINE 4' 6" ABOVE BASE LINE.
OTHER WATERLINES SPACED AT 3' 0".
BUTTOCKS SPACED AT 4' 0".



Y IS 70' 8" FROM FP, 104' 3" FROM AP.
and 3' 3" FROM Z.
X 42 IS 14' 4" FROM AP.
X 15 IS 18' 9" FROM FP.
ROOM AND SPACE 26".

See also TABLE N°1.

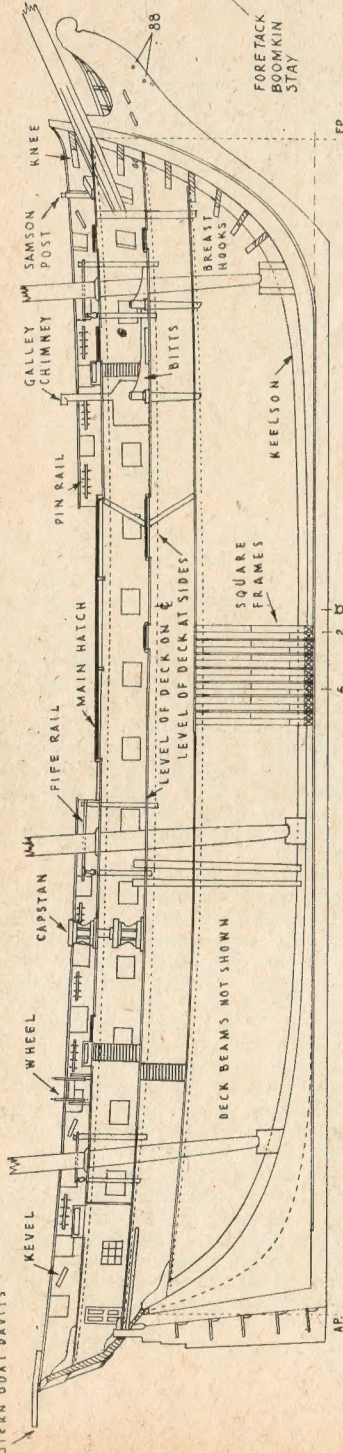
SHEET 1.



TOPSIDES ALTERED AFTER REBUILDING

HULL DETAILS

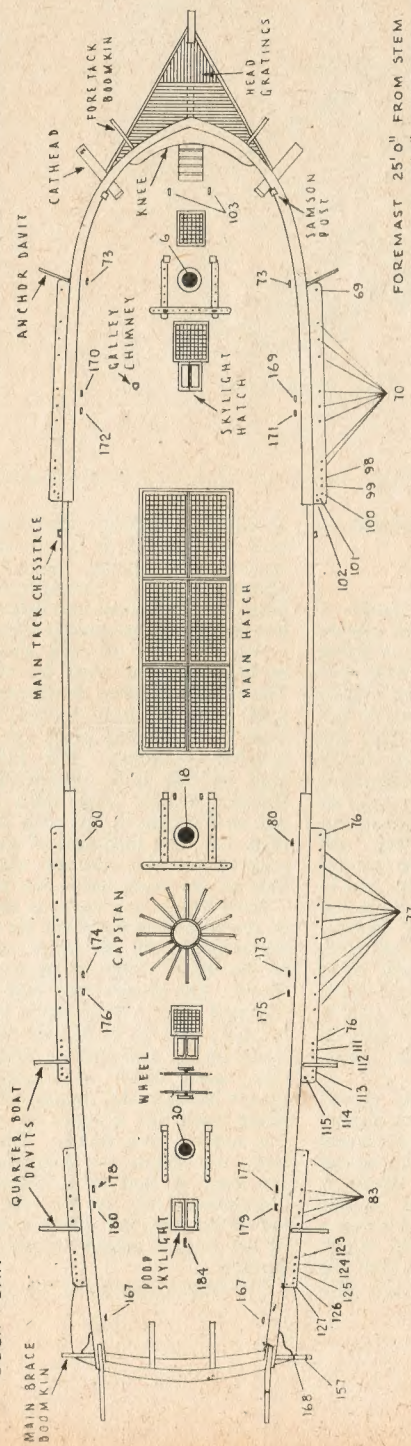
STERN BOAT DAVITS



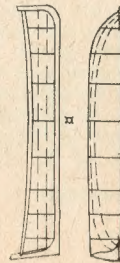
IDENTIFICATION NUMBERS OF SPARS AND RIGGING INDICATE RING BOLTS & DEADYES FOR ATTACHMENT OF THE RIGGING TO DECK AND BOWS.



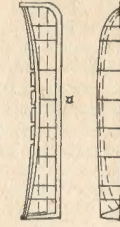
DECK PLAN



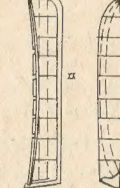
SHIPS, BOATS



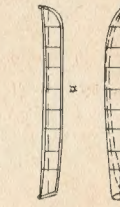
LAUNCH 34' x 9'7" x 3'9"



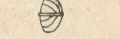
FIRST CUTTER 32' x 8' x 3'7"



SECOND CUTTER 28' x 7' x 3'2"



THIRD CUTTER 26' x 6' x 2'11"



QUARTER BOATS 25' x 6'3" x 2'5"

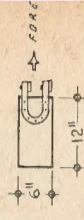
All boats except stern and quarter boats stowed on main hatch.

SECOND CUTTER 28' x 7' x 3'2"
THIRD CUTTER 26' x 6' x 2'11" (Stern boat)
QUARTER BOATS 25' x 6'3" x 2'5" Two.

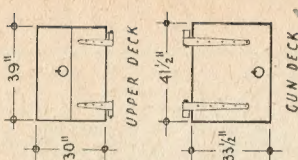
SHEET 2.

See also SHEET 12.

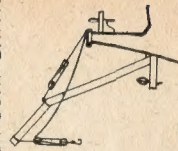
AIR SCUTTLES SHEET 1.

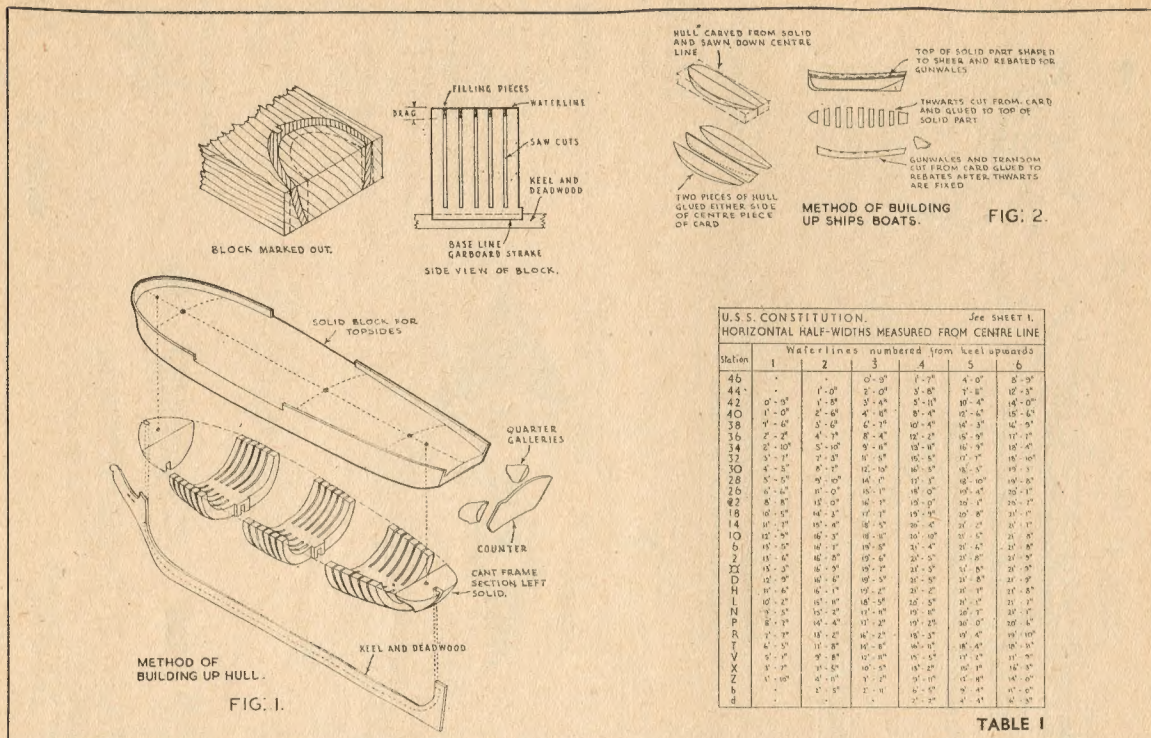


GUN PORT LIDS



QUARTER BOAT DAVITS





U.S.S. CONSTITUTION. See SHEET 1.
HORIZONTAL HALF-WIDTHS MEASURED FROM CENTRE LINE

Station	Waterlines numbered from keel upwards					
	1	2	3	4	5	6
46	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
44	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
42	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
40	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
38	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
36	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
34	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
32	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
30	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
28	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
26	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
24	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
22	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
20	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
18	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
16	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
14	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
12	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
10	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
8	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
6	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
4	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
2	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
0	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
2	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
4	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
6	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
8	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
10	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
12	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
14	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
16	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
18	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
20	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
22	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
24	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
26	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
28	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
30	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
32	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
34	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
36	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
38	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
40	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
42	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
44	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"
46	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"	0'-0"

TABLE I

—and some may be encouraged to make further research.

THE HULL

Before commencing a model I think it is essential to have clearly in one's mind the object one is trying to achieve. For example, a true scale model must be such that all visible detail is shown, or it must be a sectioned model so arranged that the parts to be exposed are all clearly seen in the model. A representative scale model must be true to scale so far as the detail that is included, but only such items appear that will result in a model giving the general appearance of the actual ship, and in this case emphasis may be upon the hull, the spars or the rigging, depending upon the amount of authentic information available. Finally there is the scenic model in which emphasis is placed upon the purely artistic side and such matters as sails, a modelled sea and a painted background may be added.

In this case a waterline model would have been sufficient to display the rigging, but as the lines of the hull are interesting and form an important part of the model as a whole it seemed unfortunate not to include them. On the other hand I felt that a solid hull, shown full depth, would appear heavy in comparison with the spiderwork of the rigging and give

an unbalanced effect; the depth of the hull is some 20 ft or so while the spars and rigging extend 220 ft above the deck. I compromised by faking an unplanked hull below waterline to lighten the general effect.

An odd piece of teak about 1 in. in thickness was used for the hull. The keel, including deadwood, stern post, stem and head timber, was cut from a single flat piece of oak of suitable thickness. For the lower part of the hull, representing the frames, section lines were marked out on the teak in line with the grain (Fig. 1). The thickness of the wood allowed for six stations along the hull at the scale used—see Sheet 1.

Each block was sawn to the shape of the widest frame in the six stations represented, and the inside cut away to the inner profile of the narrowest frame. The blocks were then roughly trimmed to fair lines inside and out. A notch was cut to fit over the deadwood on the keel and the blocks were then sawn down to represent the spaces between the frames, allowance being made for a space to occur at the end of each block. The effect, when the blocks are assembled along the keel, is that of a framed, but unplanked, hull. At the cant frames the blocks were left solid and the lines of the frames scored on the finished surface.

The final trimming of the outer and

inner surfaces was completed after the blocks had been fixed to the keel. Small slips of sycamore—used as filling pieces in the spaces from berth deck level to load waterline to give a contrasting colour—were used as stiffen the upper ends of the frames.

Above the load waterline the hull is solid, and the thickness of the wood was sufficient to include the bulwarks. I carved the deck down from rail level leaving the bulwarks standing, but it might have been easier to make the bulwarks from separate strips fitted into rebates in the hull.

It will be noticed on Sheet 1 that there was a considerable modification of the bulwarks which, in the building draught, were shown as open rails with the gun ports between heavy stanchions. During later alterations the bulwarks were planked, leaving a section of the waist open and no doubt altering the position of the gun ports so that the field of fire was not obstructed by the rigging. Further alterations to be noted are in the design of the head rails and the position of the catheads.

In the model the junction between the hollow and solid parts of the hull was made at the load waterline, which provides a completely flat and level section across the hull. Care must be taken to observe the drag or difference in level between the keel

and load waterline, as shown in the building draught on Sheet 1.

When the two parts of the model hull were screwed together the whole was checked and finished to proper profiles before adding wales, gun ports, channels, etc. The pronounced outward flare of the fo'c'sle bulwarks should be noted.

Gun ports in the fo'c'sle and quarter-deck bulwarks were drilled and finished to size with a small square file; this part of the work requires considerable care to get the holes clean and sharp, the correct size and the sheer of the deck followed. No lids were made for these gun ports. The gun deck port lids are black on a white strake and after painting the outside of the hull the port lids were represented by rectangles of black paper glued on. I found this the most satisfactory way of making a neat clean job at this scale, and any piece of paper not quite in the right place may easily be removed and replaced.

Ports not square

It will be seen from the draught on Sheet 1 that the ports are not square, but have vertical sides with the sills and heads parallel to the deck at the point below the port. Before 1825 the gun port strake would be yellow and the insides of the bulwarks red or brown, but after 1835 both were white. The remainder of the hull is black, with copper sheathing below waterline.

In the model the main wale and rails were cut from Bristol board and glued in position on the hull. The moulded plank sheer can be neatly represented at this scale by a back thread glued along the sides.

All appropriate details may be added to the hull at this stage, but it was my aim to avoid overloading the hull with detail in case the overall effect became unbalanced. Sheets 1 and 2 show such details of the hull as could be accepted as correct during some period of the life of the ship. Whatever is added or omitted it is necessary to include the eyes in the deck and in the bows for the attachment of rigging—and these I made from fine pins driven into the deck with a touch of glue to make certain that they would not pull out.

The counter was made from a flat piece of wood shaped to the round aft, pierced for windows and gun ports and screwed to the after end of the solid part of the hull which had been cut off to the proper rake. Quarter galleries were carved and fitted between the projecting wings of the counter piece and the hull. Windows were represented by paper glued on and the mouldings by lengths of thread.

Head frames, rails and gratings were

built up from thin wood and Bristol board, but they were not fitted until the bowsprit was shipped and the gammoning completed. The rudder was made separately from the stern timber with dummy straps and pintles of copper shim, so that a very narrow slit of light shows between the rudder and the sternpost. If this is not done the effect is heavy and looks artificial.

The channels were made of thin wood, carefully fitted to the curve of the hull and pinned thereto in addition to gluing, because it is most important that they should be securely fixed to withstand any pull from the rigging. Full reliance should not be placed on the attachment of the chain plates for this purpose at a small scale.

The flush spar deck of this ship was an innovation of the period and the American preference for this type of deck—or very wide gangway—was to give as much clear space as possible for the handling of rigging and sails. The rail amidships shown on the building draught (Sheet 1) was replaced by a small wooden rail carried on light, double, iron stanchions for the hammock nettings, with gangway boards at the entry as will be shown on Sheet 12.

Figurehead replaced

The original figurehead was a Hercules with club raised to strike, but this was replaced by a carved billet-head, probably early in the life of the ship when the head rails were changed. Double gammoning of the bowsprit is shown on the building draught and persisted in the American Navy until 1815, if not longer.

At one time air scuttles were fitted just below the gun deck clamps to ventilate the berth deck, and it appears that these were later replaced by deadlights 6 in. in diameter. Details of the air-scuttle are shown on Sheet 2. Plug-stock rudders were in general use by 1812, and it is certain that *Constitution* would have this type of rudder at an early date. There seems little room for the tiller below the gun deck beams, but many draughts of American ships show the tiller cranked to give sufficient clearance.

Interesting points to notice in connection with the hull (Sheet 1) are the pronounced flare of the bows from station X forward, and that of a length of 144 ft on the keel out of a total of 175 ft between perpendiculars was built with square frames, the cant frames starting comparatively close to the bow and stern. The dead-flat is situated well forward of amidships.

The distance between the main and foremasts was nearly twice the beam,

and the distance between the main and mizzen mast half the distance between main and fore. To save much laborious scaling from small scale drawings I have given a tabulation of dimensions taken on the waterlines for each station (see Table 1). Although these may only be accurate to an inch or so they should be sufficient to give fair lines to the hull before final finishing.

Dimensions and lines of the ship's boats are given on Sheet 2, and though the number might vary slightly in different ships of the same class, their sizes and design were well standardised in the American Navy by 1815. Quarter boats, stern boat and gig for the model were built up partly solid as shown in Fig. 2, and this method should enable very neat and effective boats to be made to a small scale. The other boats, housed on the main hatch, were presumed to have canvas covers and were completely carved from the solid.

● To be continued.

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THE SPEEDICUT MANUAL OF SCREW THREAD TOOLS (Firth Brown Tools Ltd, Sheffield). 321 pages, 7 in. x 4½ in. Numerous photographs, line drawings, diagrams and tables. Price 25s.

THIS book provides a wealth of practical information on the various kinds of tools used to produce screw threads, including their specification, design, effective operation and maintenance. A very large section is devoted to taps, and it is of interest to note that over 20 different types, as distinct from sizes or pitches, are fully described. There is also advice on the selection of taps and their modification to suit special purposes and materials.

Tapping drill sizes for all standard threads in general commercial use are specified, also tapping speeds, lubricants and cutting angles, limits and tolerances, tap faults and failures, and measurement of threads by the two-wire and three-wire methods.

The section of the book devoted to external thread cutting tools deals extensively with radial and tangential chaser dies, hand and machine chasers, circular and split dies, and die nuts; also thread rolling and milling processes.

Emphasis throughout the book is given to promoting efficiency in all screwcutting operations and it will therefore be most helpful to production engineers and toolroom managers, but it is a very useful reference book for engineers in every field of practical work. All tables are taken from British Standards Specifications, by permission of British Standards Institution.

# Making a MODEL MYFORD LATHE

This was L. J. ROE's way of paying tribute to his "best buy."

The story, however, didn't end there for at the 1956 M.E.

Exhibition the model was awarded a Silver Medal

WHILE casting round for a prototype to model, I mused that my ML7 had given me more pleasure per unit of cost than anything else I had ever bought.

Furthermore, I considered, it was the prettiest—as well as the most efficient—piece of machinery that ever graced a workshop, and had earned a niche in history like its noble forebear, the Drummond. I decided to model it.

Disliking hand work, machining was used almost exclusively, a touch of a honing stone used here and there and milling being resorted to rather than sawing or filing.

No serious drawings were used, only sketches and details of the curved

surfaces were obtained by bending sticks of solder to the outline of the prototype.

A start was made on the only casting used—the bed.

A pattern was cut from a piece of beech, chiefly by milling in that valuable workshop adjunct, a Pools miller, by means of a cutter made of mild steel, case hardened, each side being done in one pass. Of course a considerable amount of sandpapering followed to achieve the flowing curves that make the ML7 look so well. I bore in mind the foundryman's exhortation . . . forget the paint but *not* the sandpaper.

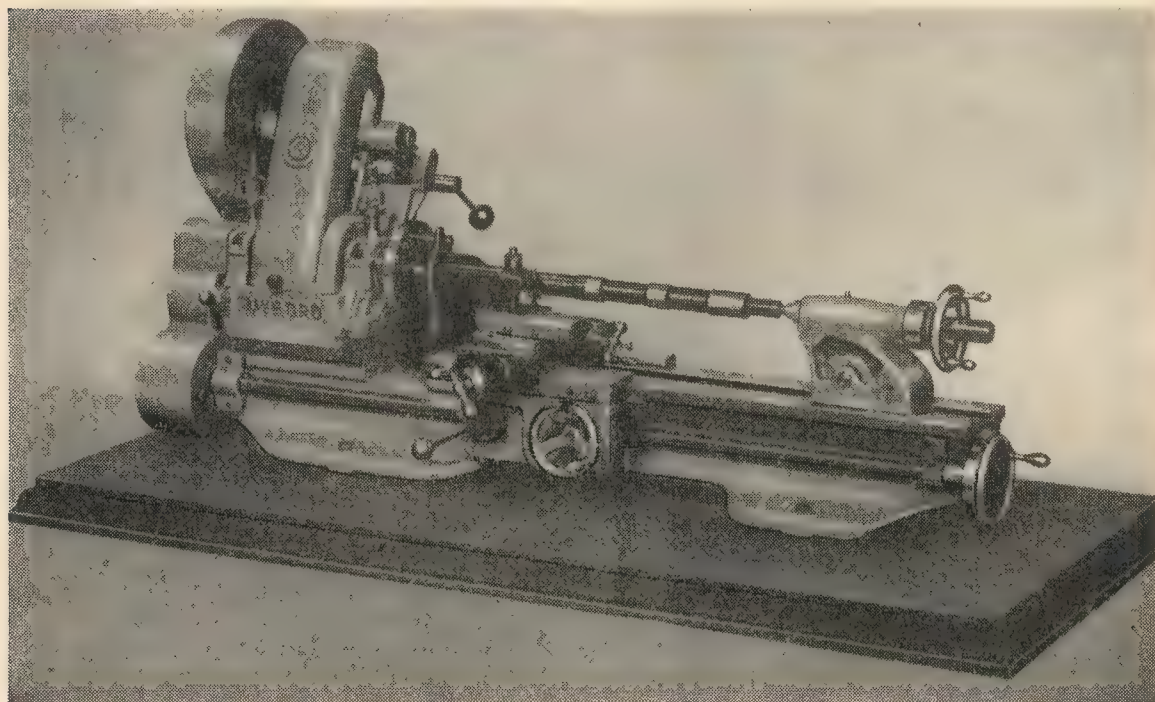
Having got the casting, which was solid, I first levelled the underneath of the feet with a flycutter and tapped a

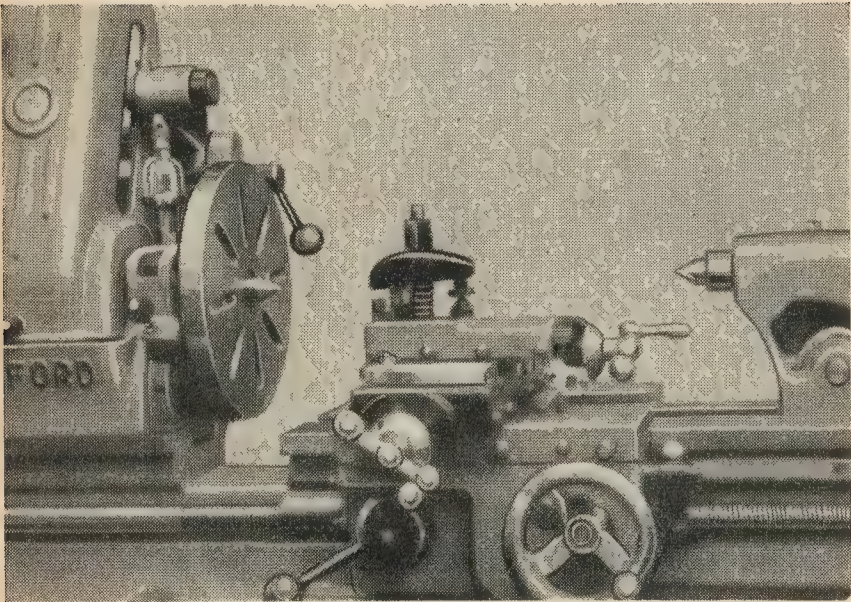
$\frac{3}{8}$  in. hole in each foot. By means of a stud in each hole the casting was bolted to two aluminium blocks—previously keyed a nice sliding fit in the slots of the milling machine table—and afterwards faced on the vertical side with a flycutter.

This enabled me to slide the casting along the table without losing accuracy, necessary because the model bed was some 3 in. longer than the travel of the mill slide—and it was this fact that determined the scale of the model.

First the top surface of the ways or shears was milled with a  $\frac{3}{8}$  in. end mill, then a  $\frac{3}{8}$  in. slot was milled to full depth and afterwards opened to  $\frac{7}{16}$  in. for half its depth. The trough of the bed was then formed—in one cut—by a shaped cutter made of

*A chip off the old block . . . yes, it is the model !*





*A close-up of the model showing the faceplate, saddle and tailstock*

silver steel. It was a treat to see that cutter plough through the cast iron which was coarse grained and hard.

Another bit of silver steel, shaped like a T-slot cutter, was then used to rough out the underneath of the ways, the job then being left for a day or two to relieve stresses before taking a final cut to finish important surfaces. The job was thus done in one set up—apart from sliding it along the mill table. The many holes were then drilled and tapped and the bed painted and put aside. All the parts of the model were done similarly, that is finished and painted before passing on to the next job.

The ML7 headstock and tailstock are very curvaceous pieces, many of the curves being arcs struck from centres "off the job," so after being roughed out by drilling, and finish milled on the base, a piece of  $1\frac{1}{4}$  in.  $\times$   $1\frac{1}{2}$  in. steel was attached to another chunk and bolted to the lathe faceplate thereby. On this second piece the various centres were marked out and centre popped.

Each centre pop was set in turn to run true in the lathe by means of a wobble pin and the faceplate removed from the lathe and screwed to the dividing head mounted on the vertical slide. The curve was then milled by end mill, the same process being used in all planes for both headstock and tailstock, which were thus finished in one piece almost without filing. Only the headstock had a piece added—a bit of bar, which was brazed into the previously bored bearing housings to form interior bosses.

All the end mills used had to have radii stoned on the points so that the various surfaces merged without sharp corners.

There were some hair-raising moments while milling the cavity in the side of the tailstock as there are numerous curves of short duration—and by the very nature of the job I couldn't see what was going on.

Not being completely satisfied with the accuracy of the bed surface—having to move it while milling—I decided after fitting the stocks to the bed to bore them in line.

I made up a spindle to fit the head bearing housings, with a tiny cutter at the end, driving this by chucking in the big lathe. The miniature tailstock, adjusted to a tight sliding fit on its bed, was pushed along by the tail centre of the big lathe, a large hollow centre being used to allow the boring bar to break through. Thus the tailstock was bored in line (self supporting) between centres.

Another spindle was then fitted to the baby tailstock, driven by round belt from a spare motor. The headstock bearings, after fitting, were bored in line by gently tapping the tiny tailstock along its bed. Then after fitting a third spindle to the finished head bearings the tailstock was finish-bored and the head bearings run in at the same time.

A start was made on the saddle and slides. The saddle, of course, was simple milling, made from a piece of  $\frac{1}{2}$  in. steel plate on the vertical slide in the lathe, but the cross-slide needed some care because of the tiny T-slots.

This was done in the Pools miller using the home-made vertical head and a Heath Robinson arrangement of belt and pulleys for self acting. Home-made cutters, not ground after hardening, do not cut completely freely and if allowed to stay in one position longer than others do not produce even surfaces—and the least unsteadiness of a tired hand in manual feeding more often than not spells the doom of the frail-necked T-slot cutter, which with self-acting produces swarf more like paint than chips.

It was important also to make the neck of the T-slot cutter a good fit in the slot, which was first put in with a slitting saw. If too loose the cutter would waggle and break, and a slight tightness was more than sufficient to wring the head off. I made, and broke, four cutters and ruined an almost complete cross-slide in finding this out.

After this, one cutter sufficed to machine the five slots without incident.

Care, too, was necessary in tapping the 10 B.A. screws in the vees, for the tap and the drill broke into the vee. All the cut was on one side but a piece of steel temporarily clamped in the vee cured that.

The felt-wiper retaining plate on the front of the saddle is held on by 12 B.A. screws in blind holes, and after a trial go I shuddered at the job before me, so I made a little jig to make things easier.

#### Details of the jig

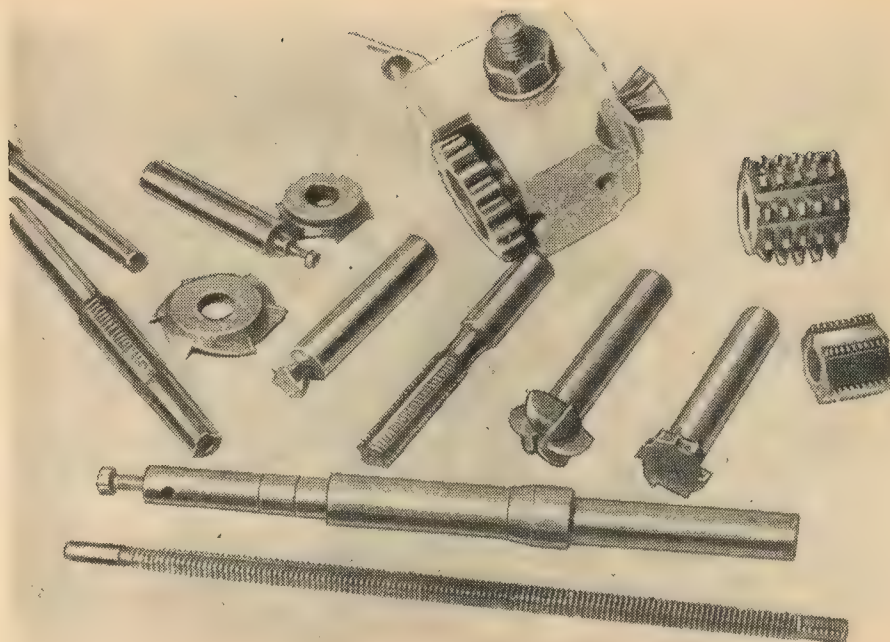
A  $\frac{3}{8}$  in. hole was reamed in a block of steel. Into this hole was inserted a short rod carrying the tap truly mounted on one end. To face the hole the tiny saddle was held between thumb and finger on a small angle-plate attached to the block and set to a suitable height. Rotating the rod with two fingers was more than enough drive for the tap; the jig prevented any bending strain on the tap and all was well.

The next item was the rack which was done in the mill. The job, a piece of steel  $6\frac{1}{2}$  in.  $\times$   $\frac{3}{16}$  in.  $\times$  0.085, was held between two 1 in. bars bolted to the mill table, and the teeth were cut with another home-made cutter which had all the angle on one side. The vertical head which carried it was adjusted to half that angle. The division was accomplished by making a .19 holeplate which was attached to the mill table, a detent arm and pin being substituted for the handle.

Delays in mid-operation, due to trouble with the primitive belt and pulley system necessary to drive the milling head at an angle, resulted in three scrap racks before I produced a

## Making a model Myford lathe . .

*Taps, cutters, and  
hobs with the cut-  
ter fluting jig*



good one. One tooth at a time . . . it was a long and boring job.

My first gear-cutting attempt was by means of a hob with no lead—just a row of straight-sided 29 deg. t. I reasoned that as the blank was indexed one tooth at a time the teeth would be generated to shape. So they were, but the shape formed was two flats, one large and one small, and I still had the one-tooth-at-a-time bogey.

My natural leaning toward power feed led me to the solution.

First a worm was made, 1 in. dia. screwed to mesh with a 40 t. change wheel. This pair were mounted in a block bolted to the mill table, the worm shaft parallel with the mill spindle. A pair of rough universal joints were made, and a piece of  $\frac{3}{8}$  in. plate bored to fit on the rear bearing boss of the mill, and clamped thereon, served as a change wheel quadrant.

With equal gears on both spindles I was set up for the first job, which was the milling of a proper worm-wheel.

This was done with a home-made hob. Like a tap, it is screwed to suit 20 d.p., the same as the change wheels. (I had an eye for the future and have since made many odd-sized change wheels with the same hob.)

The new wheel and the original worm were mounted in a casting made for the purpose, bolted to the mill table and driven by a telescopic shaft carried on the universal joints.

Reasonable gears were produced so long as power feed was used. I made a ratchet device which fed the table

along about eight thou. per rev. of the blank, so that once started the device was completely automatic.

Not the least advantage of hobbing is the fact that accurate tooth shape is achieved with a straight-sided—and therefore easy to screw—hob. Any number of teeth can be cut with the same hob.

With a 40 t. gear on the mill spindle the outfit will duplicate such number of teeth as are on the driven gear second shaft. Other numbers can be obtained by suitable ratios, of course.

The teeth of all the miniature change wheels, tumbler gears and back gears—done a pair at a time—took about two hours.

The lead screw is 13 in. long, and  $\frac{7}{32}$  in. in diameter and being unaware that steel of that size could be obtained I set about machining some  $\frac{1}{4}$  in. to size. Support of some kind was obviously necessary, so I set about making a travelling steady.

First I made a silver steel bush  $\frac{1}{2}$  in. dia. with a lapped  $\frac{7}{32}$  in. hole, hardened and tempered.

During the hardening I noted the usual expansion, but learned something I had not known before, i.e. that the expansion disappears with tempering. I had hardened, lapped and then tempered, so had to lap again.

Then a piece of steel plate, 3 in.  $\times$  4 in. and  $\frac{3}{4}$  in. thick, was trued on both ends in the lathe, a  $\frac{1}{4}$  in. hole drilled 1 in. deep at one end and a  $1\frac{1}{2}$  in. square hole pierced through the plate, so that the  $\frac{1}{4}$  in. hole broke into it. By this means the plate

was bolted to the saddle in the position provided for it.

A  $\frac{1}{8}$  in. hole was then drilled and reamed through it in position and into this hole the bush was pressed. The top front corner of the plate had to be cut back to allow the topslide to pass.

With the topslide out as far as it would go and a tool on the extreme edge of it so that the tool would go in between steady and chuck, the first inch of a piece of  $\frac{1}{4}$  in. steel, projecting about that much from the chuck, was reduced to a running fit in the steady bush. The saddle was then run up to the tailstock, the rod brought out of the chuck and the  $\frac{7}{32}$  in. portion inserted into the steady bush without moving the tool from its last cutting position and keeping it quite close to the steady.

With a fine feed and liberal injections of soluble oil—the latter was necessary to prevent the heat of the cut causing jamming in the steady—lengths of quite good  $\frac{7}{32}$  in. rod were made.

Screwcutting proceeded without incident—after I had learned that it was essential for the steady to *precede* the tool and not follow it. I set up the latter way at first, and found that the burr left by the tool caused the job to jam hard in the bush, usually right in the middle of the job. With the tool behind the steady and close up to it, the burr being gently filed off before returning the saddle after a cut, three or four lengths were screwed, one in silver steel for use as

a tap for the split clasp nut. The tiny gear for the model screwcutting indicator was also hobbled with it.

The  $\frac{1}{8}$  in. dia. feedscrews for the compound slide were done similarly and with the same tool, which was made originally with a smaller flat on its nose to suit the 30 t.p.i. and then ground back a bit for the 24 t.p.i. leadscrew.

In making the taps for the lead-screw nut, cross-slide nut, tailstock handwheel, etc., I followed my usual practice of standardising the shanks of them—as I do also with small cutters—to  $\frac{3}{16}$  in. This simplifies the milling of the flutes by means of a small jig.

I reamed a hole in a small block of aluminium, inserted the shank of the cutter into this, with a little 12 t. gear attached to one end; a  $\frac{1}{16}$  in. screw with a coned end served as a detent.

The jig can be held in the tool post, or one bolt suffices to hold it on the cross-slide or mill table, and the flutes put in by the end mill. I found that a second look at the set up was advisable, however, as on several occasions I found the resultant flutes facing backwards.

It was necessary to take particular care in making the screwcutting tool.

front and a pair of vees on the back. To obtain decent meshing between rack and rack pinion a temporary block of brass, carrying the rack pinion, was screwed to the rear of the apron by small screws in large holes so that adjustment was possible.

The apron was then removed, chucked in the lathe and the pinion set to run true. The block was then removed and the apron bored out for the pinion shaft bush. Another block was then made, counterbored to accommodate the reduction gears.

I then turned my attention to a job I had been avoiding, namely, the milling of the handwheels, being keen to see the small saddle running up and down its bed.

They were turned and milled from the solid in the lathe, after turning the chuck was fitted to the dividing head on the vertical slide. Three or four were scrapped before I thought of drilling three holes in the blanks where the spaces between the spokes were going to be. By this method I was able to compare the shape of one side with the other and get some idea of thickness before the tricky end-milling operation was commenced.

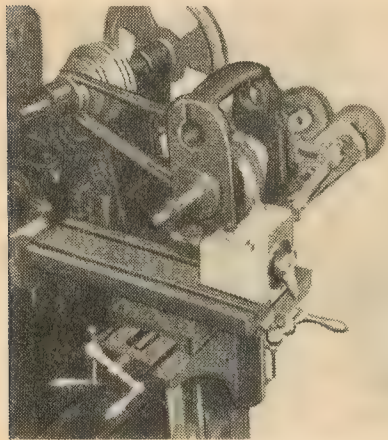
As great care was necessary I found

After having one or two jobs fall to pieces while being silver soldered, I conceived the notion of making the bits self-supporting by interlocking. The large pulley on the countershaft, for instance, comprised some 14 pieces.

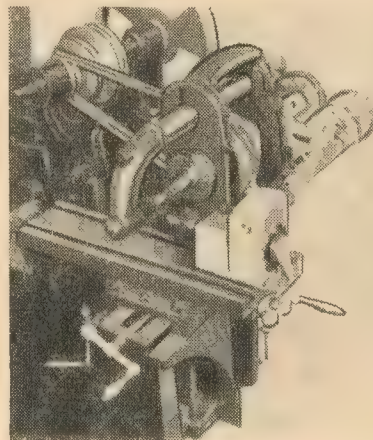
The fins of the spokes were inserted into slots milled in the spokes, the whole also fitting into grooves turned and milled in the boss. The assembly, after silver soldering, was then mounted on a stub mandrel and the ends of the spokes carefully turned to fit the rim which was also slotted to receive them. The outer ends of the spokes were then silver soldered—one at a time with a tiny flame to minimise the expansion of the rim. Microscopic quantities of Easy-Flo were used to prevent ugly blobs forming.

The countershaft stanchion and rocking frame were made in the same manner, all the parts—milled rather than filed—fitting into slots provided for them. The assembly proved sufficiently self-supporting to permit its turning round while hot enough to ensure the silver solder flowing where it was wanted.

At odd times between making the



Left: The hobbing attachment set up on the milling machine table and, right: the attachment with the overarm centre support in position



It was ground and honed to 29 deg. with equal angles on both sides, so that when set at 90 deg. to the job I was assured of a thread that was not lop-sided. Only minimum cutting clearances were provided, provision for the helix of the thread being made by a wedge-sectioned packing piece. A few to-and-fro cuts were made before going to full depth. I have since learned that in cutting long Acme threads it pays to go first to full depth with a thin "parting" tool. Believe it or not, I find it easier to cut square threads than vee ones!

Then followed the making of the saddle apron, a simple job, comprising a piece of steel milled to shape on the

it a good idea to finish one aperture first, taking careful note of the indicator readings and remembering whether they were taken going up or down or in or out. Thus the three apertures were at least similar in shape and size.

A 25-hole plate for the dividing head had to be made to obtain the 125 divisions on the small handwheel.

Engraving was done by a scribe held in the lathe mandrel before the job was removed from the dividing head. By this time cold weather made jobs requiring the use of a blowpipe more welcome, so I turned my attention to the fabrication of the several minor "castings."

main parts I experimented with the letters for the headstock. Sawing and filing proving an impossibility, I again resorted to machining.

A chuck of steel with a  $\frac{1}{8}$  in. hole in it was bolted to the cross-slide. Into this hole a piece of brass bar was set standing vertical and made adjustable for height. A piece of  $\frac{1}{8}$  in. square copper was soldered to the top of it and brought up to centre line.

Two flycutters, ground to suit the angles in the letters *M* and *Y*, carried in a bar between centres, sufficed to cut the exterior of all the letters. In the case of the *R* and *O* a little steering was necessary, done by turning the brass pillar in its housing. The *F*, of

## Making a model Myford lathe . . .

course, was done with a slitting saw, some drilling and filing finishing the R, O and D.

After removal from the  $\frac{1}{2}$  in. rod, the letters were clamped to the tinned surface of the headstock by means of an aluminium bar, cut to Vee section so that the letters would be easily visible and the Vee edge would crush where necessary to conform to the unflat surface. They were then tapped gently into position and soldered by heating up the headstock. The clamp made it possible to shake off all surplus solder.

About this time a friend presented me with a motor. It had reasonable power and proportions near to scale. I made an exterior mount for it comprising a ring with feet brazed on. The motor, after the various knobs and dents had been removed and the ends rounded, was pressed into this. It then looked a good representation of a  $\frac{1}{4}$  h.p. motor I possess.

The model was now recognisably a Myford lathe, and the need for belt guards became apparent.

I spent hours deliberating how to make them, never having done sheet-metal work before and not particularly wanting to. Finally I decided on the following.

### Belt guard details

Circular formers were first turned up in aluminium, each with a central hole for bolting to the previously cut out and annealed brass plate. The straight edges of the guards were first bent over a round bar of the required radius; this stiffened them considerably and made handling easier. The formers were then bolted on and the rounded ends dressed over. Only about  $\frac{1}{2}$  in. of metal was left for this, the gap left being filled in by a piece of sheet bent to shape and silver soldered in, the tiny bosses for the screws of the backplate being done at the same time.

Made in 18 gauge brass, the guards proved strong enough to permit the various slots being put in by end milling in the lathe when temporarily soldered to a stiff plate for holding on the vertical slide.

The six ornamental fins on the front of the secondary belt guard were accomplished by drilling holes into which were inserted bits of wire bent U shape and thus held secure while soldering. The circular badge, which was a thin brass disc with a central spigot and bearing on its face with two annular grooves later filled with red paint, was soldered on at the same

time. Again, being firmly attached before soldering, the bits did not move when the surplus solder was taken off.

There was no time for simulating the design on the badge. I tried with a magnifying glass and mapping pen, but the finished job was disappointing. I knew nothing about photographic methods, so called it a day. The Model Engineer Exhibition was drawing near, the model considered finished, the entry form duly filled in and despatched and then something struck me . . . the model was festooned with slotted screws! I decided to do something about it.

I had read an article in MODEL ENGINEER on the making of Allen screws, but chose a sort of halfway course.

Screws were first turned up, 8 and 10 B.A. with oversize heads and the heads drilled with a hole experimentally found so that an appropriate Allen key could be driven into it. For greater convenience the long shank of the key was held in a hollow punch made for the purpose, the cranked portion being removed.

The resultant hole was only partly hexagonal, so the head was gently hammered all round. This not only perfected the hexagon—it freed the

key from the screw, which was then held in a tapped stub in the chuck and re-turned to size. The screws were blacked by being heated to purple, dipped in oil and the oil roasted off two or three times, the roasting being omitted after the last dipping. So successful was this that I scraped off all black paint from other parts and replaced it by this method.

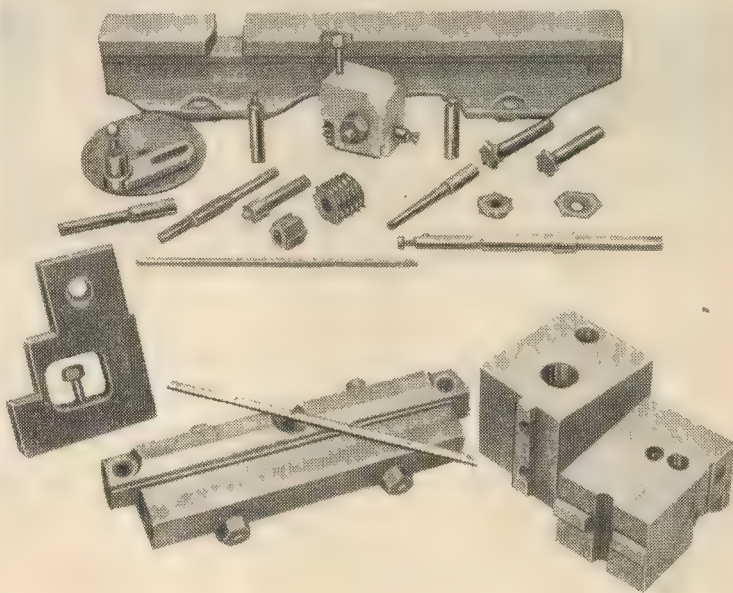
I had thoughts of making scale model belts from some form of plastic—even solid leather—but the nearness of the M.E. Exhibition and my keenness to see the model working induced me to fit spring belts. After all, it was unlikely that the model would ever be used for serious turning.

On test it proved to be an effective machine tool. Cuts of 0.005 in. were possible in open speed before belt slip became evident, despite the fact that one belt was too small and bottomed in the pulleys. Strangely enough, the use of the back gear did little in lessening belt slip.

A cut was made, using self act, along the entire length of a 6 in. test piece  $\frac{3}{8}$  in. in diameter. The tailstock adjustment had only been set by eye, but the parallelism proved to be within 0.001. I left it at that.

The making of the model has given me great pleasure. There were more interesting operations per mass of metal than in any other model I can think of—and my cup was indeed full when I was awarded a Silver Medal at the Exhibition. ■

*The bed pattern with taps, cutters, jigs and hobs*



A RECENT article on the Kitson-Still locomotive interested me immensely as I was works manager at Airedale Foundry from 1928 to 1932. The engine was then already out on trials, but a great deal of experimental work was still going on, connected almost entirely with the pistons and rings.

A full-size test plant was used for this purpose and all the experiments were under the supervision of Still engineers from London, Mr Acland being the chief. The test set was run for hundreds of hours.

I had a few trips on the locomotive, and my attention was drawn to the load stated to have been hauled. My picture shows the engine hauling a test train composed of a dynamometer car and 12 bogie coaches equivalent to between 350 and 400 tons. In this venture, Mr Gresley assisted



*Above, right: A party about to board the 400-ton train on a trial run. An interesting feature is the Sentinel steam coach (left). Below: A Kitson-Still locomotive. Col. Kitson-Clarke is the central figure with clasped hands. Both these reproductions show the engine fitted with front and side screens for the protection of engineers taking indicator diagrams and relevant data*

## Kitson-Still memories

By W. E. Carlisle



Col. Kitson-Clarke in every way possible.

The locomotive came back to the works some time in 1930 to have the crankshaft bearings and housings overhauled, after which it went on further trials, eventually going to York with a view to its running in service. Here, however, it had a major failure and coupled with the financial difficulties at that period the project was dropped.

The Kitson-Still locomotive was stabled at the L.N.E.R. Copley Hill running sheds for many months, and only on rare occasions did it come back into Airedale Foundry where the only rail connection from the Midland (Hunslet) goods yard was over a very small wagon turntable. This was a considerable inconvenience for it meant that locomotives with a long wheel base had to be jacked round. ■

### Two Books for the Workshop

#### MAKE YOUR CASTINGS

*Foundrywork for the Amateur* by B. Terry Aspin is a profusely illustrated book covering all aspects of light foundrywork. Types of sand, moulding boxes and pattern making are fully discussed and there are

copious references to the melting of iron, aluminium and cupreous alloys. Stirrers, skimmers, plungers, fluxes and inoculants are also dealt with fully. Price 5s., plus 3d. postage, from Percival Marshall, 19, Noel Street, London, W.1 (U.S.A. and Canada \$125).

#### WHY AND HOW OF SOLDERING

*Soldering and Brazing* by A. R. Turpin deals comprehensively with

three categories—soft soldering with alloys of low melting point, hard soldering with higher melting points, and using brasses for brazing with melting points of 800 deg. C. and over. Each category is discussed from the point of view of melting point, plastic range, viscosity, strength, cost and electrical conductivity. Price 5s., postage 3d., from Percival Marshall, 19, Noel Street, London, W.1 (U.S.A. and Canada \$1.00).

# A SIMPLE STEAM ENGINE—9

The merits and disadvantages of various fuels and types of burners

By EDGAR T. WESTBURY

Continued from 10 January 1957, pages 48 to 50

**O**F THE VARIOUS METHODS of firing small boilers, liquid fuel is by far the most popular, owing to its convenience and the small amount of attention which it needs under normal running conditions.

For sheer efficiency in producing heat, however, there is much to be said in favour of solid fuel if one is prepared to accept the extra work this entails in lighting up, stoking (which needs to be frequent but discreet), regulation of draught, cleaning and disposal of ash. My own experience with solid firing is very limited, and I do not propose to stick my chin out by making statements about it without practical backing.

I may say, however, that I have had an all-too intimate acquaintance with firing full-size marine boilers, both Scotch and water-tube types, entailing the shovelling of many tons of coal into the insatiable maw of the furnaces. How glad I was when the Navy decided to change over to oil fuel, when the ordeal of "coaling ship" was abolished, and the hardest labour involved was the connecting up of a hose and the turning of a wheel valve. From the point of view of those who have to do the job, there is something to be said in favour of modern developments, after all!

Some useful practical hints on solid-fired boilers were given by my friend Bob Mapplebeck some time

ago, based largely on actual experience with a Gurney type water-tube boiler, and so far as my knowledge goes this information is fully applicable to all other types of small boilers.

There is, of course, a wealth of experience available on solid firing of locomotive boilers, and though they are of a rather specialised type there is no reason why they could not be adapted to stationary or even marine work. Indeed, typical locomotive boilers have been employed for stationary work, including the well-known "overttype" and "undertype" self-contained units which were once popular for small-power semi-portable plants.

## LIQUID FUEL BURNERS

Where any kind of liquid fuel is used it is most important to employ a burner which is not only capable of producing efficient combustion but is also suitable for the particular conditions in which it is to be used. There is no single type of burner which is universally applicable to all kinds of small boilers, both vertical and horizontal, and internal-flue and water-tube types.

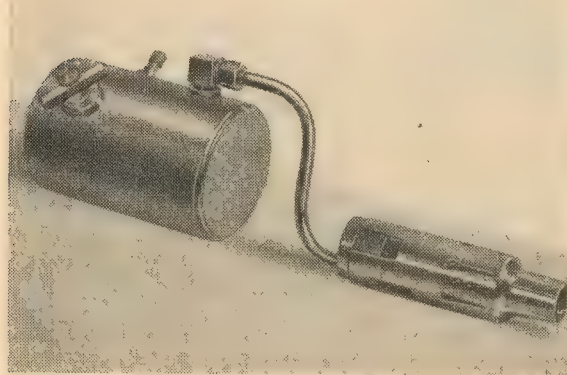
Complete combustion of fuel demands a certain amount of free space, and in this respect solid fuel has the advantage because in boilers specially designed for it the fuel can be laid in a shallow grate, at a low level, with a fair amount of free space above it in the firebox.

With liquid fuel, the space occupied by the burner—sometimes fairly bulky—must be allowed for, and can often ill be spared. Vertical boilers can usually be made with fairly deep fireboxes or with additional accommodation space underneath, and as the natural convection flow of the hot gases is directly upwards, they are often found easier to fire efficiently than horizontal boilers.

Paraffin burners are nearly always of the pressure vaporising type, and ready-made burners on the well-known Primus principle can usually be adapted with or without the standard form of reservoir, directly or indirectly connected. Given reasonable firebox space, and adequate ventilation, these burners work very efficiently, and where they can be accommodated it would be extremely difficult to improve on them.

I have found that of the two standard types of Primus burners, the "Roarer" gives less combustion trouble than the "Silent," and is less prone to carbonisation. The flame guards or caps tend to burn out rather rapidly when they are used in enclosed furnaces but they can be renewed quite cheaply.

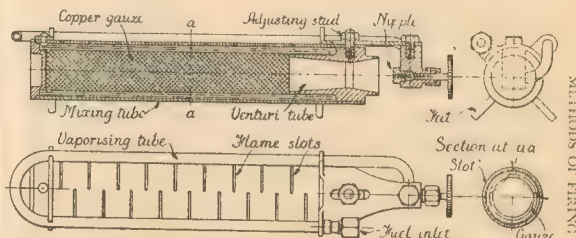
This type of burner, however, cannot be used in small internal-flue horizontal boilers, as quite apart from the space it takes up the flame cannot develop properly in a small flue, and the only possible burner for this form of boiler is the "torch"



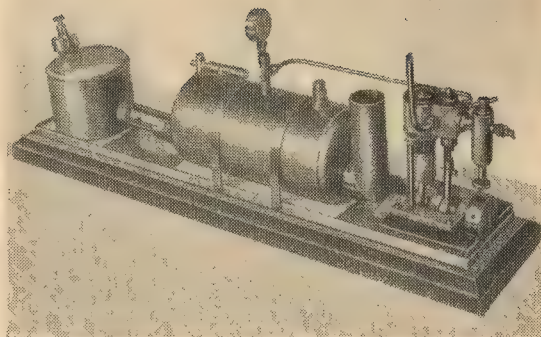
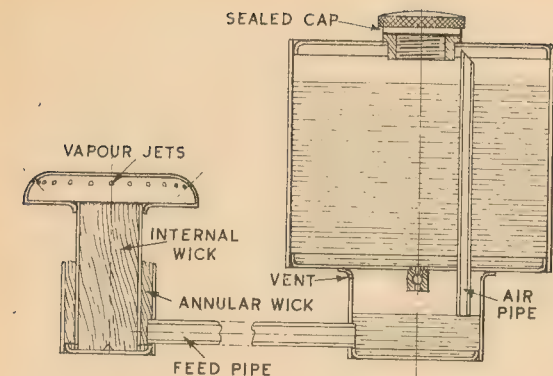
MODEL ENGINEER

Left: A typical "torch" blowlamp for boiler firing, with standard burner. Made by the Imperia Co. of Ilford

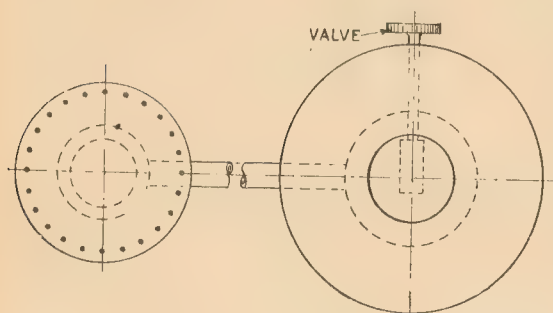
Below: Details of a diffused flame vaporising burner



METHODS OF FIRING



*Above: Small marine power plant sold by Bonds o' Euston Rd. It has internal flue boiler fired by self-pressurising spirit blowlamp*



*Left: Mushroom-type spirit vaporising burner with constant level "bird-feed" supply system*

type which gives a straight, small-diameter flame of high intensity, and which will burn in practically any direction if properly ventilated.

The fact that this type of burner is well known to most engineers, and is not difficult to construct, no doubt accounts not only for the popularity of the burner itself but also the prevalence of the internal flue horizontal boiler, especially for marine models.

Unfortunately, however, the high-intensity flame is not the most efficient for boiler firing and it has the further disadvantage that it has an injector effect which tends to draw cold air into the furnace. This hinders rather than helps the general heating effect unless this air can be made to pass through the flame, but this is difficult as the latter resents any interference with its straight and narrow path. For any other purpose than boilers with narrow furnace flues, therefore, the torch type burner is undesirable.

Most water-tube boilers are arranged so that the gases have a more or less upward direction of flow, but in many cases, especially in marine models, the furnace space does not allow of using a standard Primus

type of burner. These boilers are often fired by torch burners, but for maximum efficiency I have always recommended the low-intensity diffused-flame type of vaporising burner; I have used it with success in my own experimental work.

The burner described in my handbook *Flash Steam* (now, unfortunately, out of print) has proved very efficient in water-tube and so-called "semi-flash" boilers, and I am reproducing the drawing of it for the benefit of readers who are not familiar with the type. No originality is claimed for the general design, as burners on a similar principle have been used for firing both large and small boilers, including steam cars, and many years ago the famous model-making firm of Carsons established their efficiency for locomotive firing.

In this type of burner, the vaporiser consists of a loop or "hairpin" tube exposed to the flame. The fuel is fed under pressure, by air pump or otherwise, in exactly the same way as for the torch burner, and is discharged at the jet nipple, which may be fixed or adjustable, in the form of a vapour or gas.

Unlike the torch burner, however, the combustion does not take place

in a flame tube directly in line with the jet, but the vapour is diffused in a mixing tube and allowed to issue at low pressure from slots or other small apertures in the upper side of this tube so that it burns at low intensity but much greater volume. To ensure even discharge of vapour over the full length of the tube it is often found desirable to insert a roll of coarse gauze or a metal "pot scrubber" inside it, but this should not be in such a position as to impede the flow of vapour from the jet.

In order to assist in producing an injector effect, and also in mixing the fuel vapour with the air the entrance to the mixing tube is fitted with a reduced-diameter throat tube, preferably in the form of a venturi. This not only increases the volume of air induced, and thereby enables the maximum amount of fuel to be completely consumed, but also creates a high air velocity which prevents "lighting back" on to the jet. It is advisable to provide some means of adjusting the distance of the jet from the mouth of the tube (or *vice versa*) to obtain the best effect.

The shape of the mixing tube may be varied, such as by flattening it to increase surface area and reduce height or bending it into a ring to suit a circular firebox. Some experiment may be called for in making these variations and the relation of the vaporiser loop to the flame orifices may have to be adjusted to suit temperature conditions; I have found it best to use steel tube for this loop, as copper tubes have been burnt out on several occasions.

Some further notes on the construction of vaporising burners, including designs for burners of both the torch and the diffused flame types, may be found in the issues of *MODEL ENGINEER* dated 8 and 22 July 1954. In each case these burners have been tested and found satisfactory when

## Steam engine . . .

using normal paraffin (kerosene or lamp oil) but cleaner results are obtained by using more volatile constituents as these reduce the formation of carbon in the vaporiser or jet.

At the present moment one hardly dare use the word petrol, but lighter fuel mixed with the paraffin will improve matters in this respect. The jet size needs to be *increased* slightly for the higher grade fuels.

### ALCOHOL BURNERS

Many readers have asked for information on the use of methylated spirit or industrial alcohol for boiler firing. Despite the convenience of this fuel I do not recommend it except for the very smallest plants where simplicity is more important than efficiency. Alcohol is not only the most expensive fuel but its calorific value is low in relation to paraffin or petrol, and the fact that it does not produce smoke deceives users into thinking that it produces complete combustion—which is often far from true.

Small wick lamps, or trays filled with absorbent material and covered with gauze, are often used in small steam plants and if users are satisfied with the results obtained no more need be said about them. The same applies to the use of "solid alcohol" or meta fuel (metalddehyde, to be precise), which is one of the most convenient fuels for use on a small scale. But if one attempts to increase heating efficiency by using larger burners, or more meta tablets, imperfect combustion often results, and is all the more insidious because it is not apparent in heavy fumes or smoke.

Multiple wicks, not exceeding  $\frac{1}{2}$  in. dia., will help to ensure efficient combustion, but they should not be crowded, and ample ventilation to the individual wick tubes is essential; in some cases a mild induced draught has been found advantageous. Wherever possible the spirit reservoir, especially if it contains any substantial quantity of fuel, should be kept far enough away from the actual burner to remain cool, as alcohol vaporises at a relatively low temperature and it is all too easy to produce an alarming and possibly dangerous general conflagration of all the fuel at once. Reservoirs must, of course, always be air-vented except in pressure lamps.

The volatile properties of alcohol may, however, be used to good effect in simple forms of vaporising spirit lamps, which enable combustion efficiency to be greatly increased. It is well known that the easiest way to obtain complete combustion of most

kinds of fuel is to convert it into a gas which, being of a density comparable to that of air, mixes readily with it and supplies oxygen for combustion right on the spot.

Many simple forms of these burners have been described in *MODEL ENGINEER* in the past, most of them either working at little more than atmospheric pressure or of the "self-pressurising" type in which the expansion of the fuel by heat supplies the necessary pressure.

A burner based on the principle of the so-called "French blowpipe," in which the spirit reservoir is heated by a small auxiliary wick lamp, was described in the issue of 8 July 1954. The drawing of this lamp shows a burner tube with slots in the upper surface, for use underneath a water-tube boiler; but it will work equally well with a plain open-ended bunsen tube, as a torch burner for a horizontal internal flue boiler.

### Mushroom-type burner

Some time ago in the *Queries* column of *MODEL ENGINEER* reference was made to a mushroom-type vaporising burner; unfortunately the sketch which should have accompanied this paragraph was omitted, and as a result several further queries have been received for detailed information about this burner. It is, as a matter of fact, a well-established type which, I believe, was once in commercial production and has also been constructed by many amateurs, including myself.

The principle employed in this burner bears a resemblance to that of the well-known Britinol and Fluxite soldering lamps, in which an annular wick burner is used to heat an inner wick tube and vaporise the spirit drawn up therein from a common fuel supply. Unlike the above lamps, however, the vapour does not issue from a single jet but is distributed to a number of jet orifices spread over a large area, producing a large mass of flame.

The drawing shows the general design and construction of a burner of this type, together with a reservoir providing a constant level of fuel to the burner on the "bird-feed" principle. This may be located at any distance from the burner, so long as relative levels are maintained, and ensures consistent performance for any length of time, so long as the main reservoir is of sufficient capacity.

The main reservoir must be completely sealed by a screw cap, and the air pipe, opening into it at the highest point, extends down to the required cut-off point in the auxiliary tank, which is air vented. Fuel flows freely from the main tank until it reaches the level of the air pipe, when the

tank becomes air-locked and fuel ceases to flow until some of the fuel in the auxiliary tank is used, when the process is repeated indefinitely.

The fuel valve is a refinement which may be considered unnecessary but it at least prevents leakage while the tank is being filled; in its absence the hole in the tank should be punched from the inside, to produce a slight lip which deters creeping of fuel. It should not be too large;  $\frac{1}{32}$  in. dia. is ample for normal fuel flow in the size of burner indicated.

The mushroom burner has a single ring of jets around it, so located as to discharge the vapour at about 45 deg. Size of holes is not critical but they should have sufficient total area to discharge the vapour without setting up back pressure, which would force the fuel out of the centre tube and put the burner out of action, or cause it to work erratically. In the example shown, 24 holes, No 60 drill, are shown, but a larger number of smaller holes might be better still.

### Not too many holes

Some constructors, in the attempt to increase efficiency, drill a large number of holes all over the top of the burner so that it resembles the rose of a watering can. This might be quite effective in a very large and well-ventilated burner but it usually fails to produce the desired results in a small one because there is no access of air to the inner jets and incomplete combustion is thus caused. It might, however, be possible to utilise the principle of the Argand burner by providing a central tube for ventilation of the inner jets. Note that the inner wick tube must be notched at the bottom edge to prevent the possibility of sealing or restricting the fuel supply to the wick.

The inner tube need not be fixed but simply located in place by being made a close fit in the annular wick. Both wicks may be of woven cotton, as used in ordinary oil lamps; asbestos may be tried, but I have found it less absorbent, thus lowering the vapour output.

Other forms of alcohol burners include torch burners similar to those used for paint-burning; a self-pressurising lamp of this type, designed specially for small internal-flue boilers, is manufactured by Bonds o' Euston Road Ltd.

For those who wish to use town gas for boiler firing I can recommend the special burner which has been designed for the *MODEL ENGINEER* test boiler, and described in the issue of *MODEL ENGINEER* dated 26 April 1956. Some information on the use of "bottled" gas for boiler firing was given in the issue of 31 March 1955.

● To be continued.

# USING SUB-FACEPLATES

**T**HE NORMAL faceplate supplied with a lathe provides means of setting up components with flat bases or ends, the components being held by bolts through the plate and clamps on the front or by studs or setscrews passing through the plate and screwing into the components. For special jobs additional holes may be drilled in the faceplate and spigot and dowel holes can be used for locating purposes.

Nevertheless, to work conveniently on a faceplate, components need to be above a certain minimum size. If they are small—but still of a type best set up on a faceplate—they cannot be bolted direct owing to the size of the boss and spindle, so clamps must be used and these are necessarily large and often out of proportion, and may

even cause serious obstruction to the use of tools.

Again, there are many old lathes with solid spindles on which it is not possible to employ the drawbolt principle—using a long bolt right through the spindle to hold a component on to a faceplate or jig at the front. Consequently, here too there is a handicap on some classes of work.

In both cases, however, the solution is to use a sub-faceplate, which in principle is merely a flat plate on which components can be attached in whatever is the most convenient way—the plate itself either being held in the chuck, or mounted on the normal faceplate. And with the sub-faceplate projecting from the normal faceplate there is a flat face and access to the rear for fitting and tightening bolts and nuts used for holding components.

Most normal materials can be used

for sub-faceplates in the form of parallel discs for holding in the four-jaw independent chuck, or flat rectangular bars—for similarly mounting—or attaching to the normal faceplate. Aluminium alloy, brass and mild steel can be used; and the most convenient thicknesses are  $\frac{1}{4}$  in. to  $\frac{3}{8}$  in. If desired, a simple casting could be obtained from a wood pattern and machined.

At *A* is shown a parallel disc mounted in the independent chuck—jaws reversed—for a small component to be clamped by its flange to the front. To ensure true running the disc should be faced after mounting—for which reason soft material like aluminium alloy is best.

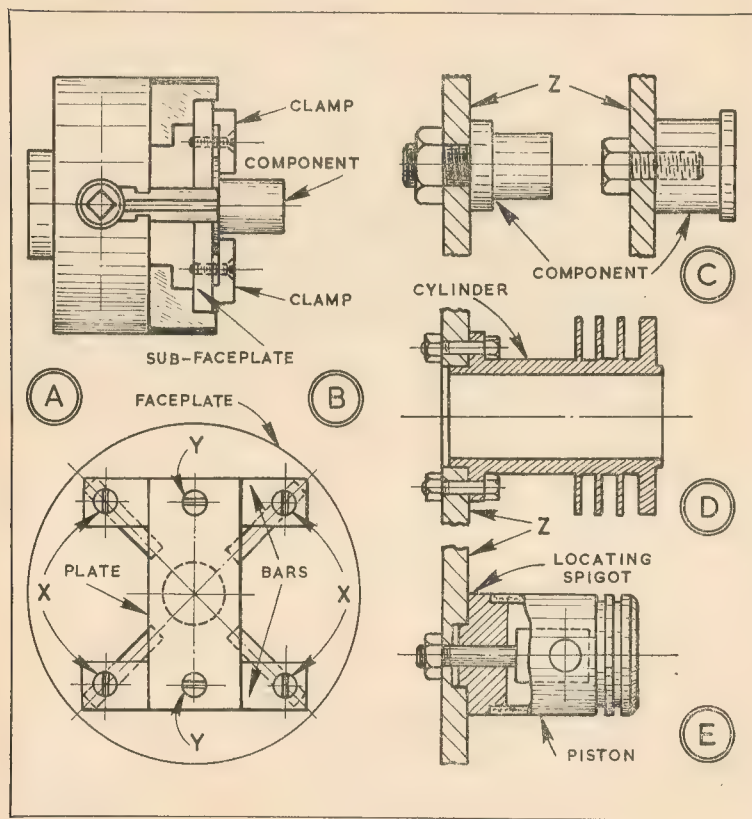
Countersunk screws for the clamps minimise obstructions at the front; and instead of the screws screwing into the plate they can be spaced between the chuck jaws, pass through clearance holes in the plate and be provided with nuts on the back. In setting up the clamps are only partially tightened until the component is running truly.

## Small component set-up

At *B* appears a plate mounted on the normal faceplate. Two flat bars about  $\frac{1}{2}$  in. square are attached to the faceplate with countersunk screws, *X*. Then the sub-faceplate is attached to the front with screws, *Y*, which pass through the bars and the normal faceplate (holes being drilled) and are provided with nuts at the back. Again, the sub-faceplate can be faced true for mounting components.

At *C*, *D* and *E*, where the sub-faceplate is marked *Z*, are typical set-ups of small components. For any pedestal-type part, the plate can be centred and drilled from the tailstock, the hole chamfered at the front, burrs filed off the back; then the component can be mounted with a nut. For a component with a tapped base, the preparation can be the same—then a setscrew used for holding, or a short piece of studding and a nut.

For a small engine cylinder the plate can be bored through, then holes drilled for mounting the cylinder by its flange—when the bore is to be machined or ground. For a small piston, the drawbolt principle can be adopted. A locating spigot should be fitted to the plate, then a stud screwed into a block which is drilled crosswise to take the gudgeon pin. ■





# LOCOMOTIVES I HAVE KNOWN

NUMBER 25

By J. N. MASKELYNE

THESE astonishing little engines have a prominent place in my earliest recollections which go back to 1897. At that time, when I was still under six years of age, I had begun to differentiate clearly between the various classes of Brighton engines, most of which could be seen practically every day passing Wandsworth Common.

These small 0-6-0 tank engines, officially styled Class A but more usually referred to as "Terriers," "Pups" or "Rooters," worked many of the local trains that shuttled to and from Victoria and London Bridge via either Crystal Palace or Norwood Junction, and they could be readily distinguished by reason of their very small size, clearly apparent even to a child of my age.

They originated in 1872, between which date and 1880 no fewer than 50 were built; and they were certainly to be included among Stroudley's masterpieces. It is interesting to note that 13 of them are still at work in the Southern Region of British Railways, one in its original condition and 12 reboilered, while a fourteenth, No 82, *Boxhill*, restored to her original state and painted in Stroudley's striking livery, is withdrawn for permanent preservation.

At first, in 1872, only six were built; but after thorough trials, the class was gradually increased to 50 by the addition of the following batches: six in 1874, 12 in 1875, six in 1877, six in 1878 and eight in 1880. In spite of their small size they were excellent workers with a truly astonishing versatility. They were popular with the enginemen and with passengers on the East and South London Railways.

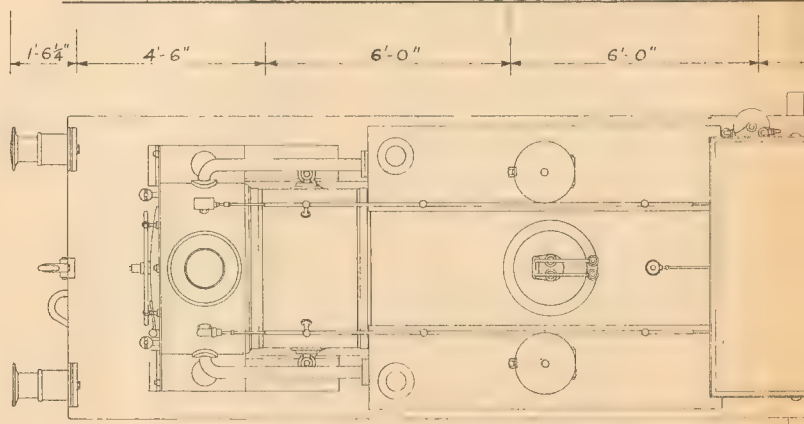
There can be little doubt that their attractive yellow colour with its elaborate lining-out, and their usual spotless cleanliness, found great favour with the travelling public in a rather drab district. But very soon they were to be met with all over the Brighton Railway, and to see them working in rural Surrey and Sussex was to

appreciate how well they harmonised with lovely scenery.

The original dimensions were: cylinders, 13 in. dia.  $\times$  20 in. stroke; wheels, 3 ft 11 in. dia. on a wheelbase of 12 ft equally divided; the overhang, including bufferbeams, was 4 ft 7½ in. at the leading end and 6 ft 7½ in. at the trailing end, the total length of the frames being 23 ft.

The boiler was made of  $\frac{7}{16}$  in. iron plate, the barrel being formed of three

## The BRIGHTON TERRIERS



rings, the middle one of which was 3 ft 5½ in. outside dia.; the length of the barrel between tubeplates was 7 ft 10 in., and it was pitched 5 ft 8½ in. above rail level. There were 121 tubes of 1½ in. dia., 8 ft 4½ in. long. The outer casing of the firebox was 4 ft 1 in. long, 3 ft 6½ in. wide and 3 ft 10½ in. deep.

The total heating surface was only 518 sq. ft made up of 463 sq. ft for the tubes and 55 sq. ft for the firebox. The grate area was but 10 sq. ft, and the working pressure was 140 p.s.i. The capacity of the water tanks was 500 gallons, and that of the coal bunker about 18 cwt. The total length over buffers was 26 ft ½ in., and in full working order the weight was 24 tons 7 cwt. At 85 per cent. boiler pressure the tractive force was 7,650 lb.

The valves worked in a steamchest placed between the cylinders and were driven by Stephenson link motion having the weighshaft above; in full gear the valve travel was 3½ in. The ports were 1½ in. wide × 10½ in. long,

and the cylinders were inclined 1 in 11.

Engine No 40, *Brighton*, was exhibited at the Paris Exhibition in 1878 and won a gold medal for excellence of design and workmanship. Subsequently she was stationed at Battersea and for many years was a familiar object in the South London suburban area, proudly displaying the legend "Gold Medal, Paris Exhibition, 1878" painted above the name on her side tanks.

At one time, there was a turn of duty which entailed the daily working of a main line train by one of these diminutive engines. A heavy afternoon train from the South Coast to London would stop at East Croydon to be divided. The express engine would then go forward to Victoria with the front portion of the train, leaving the rear portion to be taken to London Bridge by the East Croydon pilot.

The latter at that time was usually a New Cross "Terrier," often No 57, *Thames*, which would take this means

of working home after her turn of pilot duties was finished. The time allowed for the 10½ mile non-stop run from Croydon to London Bridge was, I believe, 17 minutes; but *Thames*, hauling four or five main line coaches, had no difficulty in keeping to schedule, and often attained a maximum speed exceeding 60 m.p.h. down the New Cross Bank.

It was a choice spectacle which richly entertained a select little band of schoolboys, myself among them, who were sometimes fortunate enough to be able to visit the lineside just south of Forest Hill station where *Thames* would be pretty well into her full stride.

But this was not the only turn on which a "Terrier" could be entertaining. Years later, around 1909, when we lived at Edenbridge, I made close acquaintance with that popular type of "auto-train" consisting of a "Terrier" coupled to what was colloquially known as a "balloon," i.e. a fine, wide bogie vehicle of saloon type with a high elliptical roof. Of course, it completely dwarfed the engine; but the speed that this combination would reach was surprising.

One summer evening, I timed No 677 (old 77, *Wonersh*) and a "balloon" at 63 m.p.h. just south of Hilder's Lane tunnel, and I wondered if she would succeed in stopping at Edenbridge Town! But the engines seemed to revel in this sort of thing.

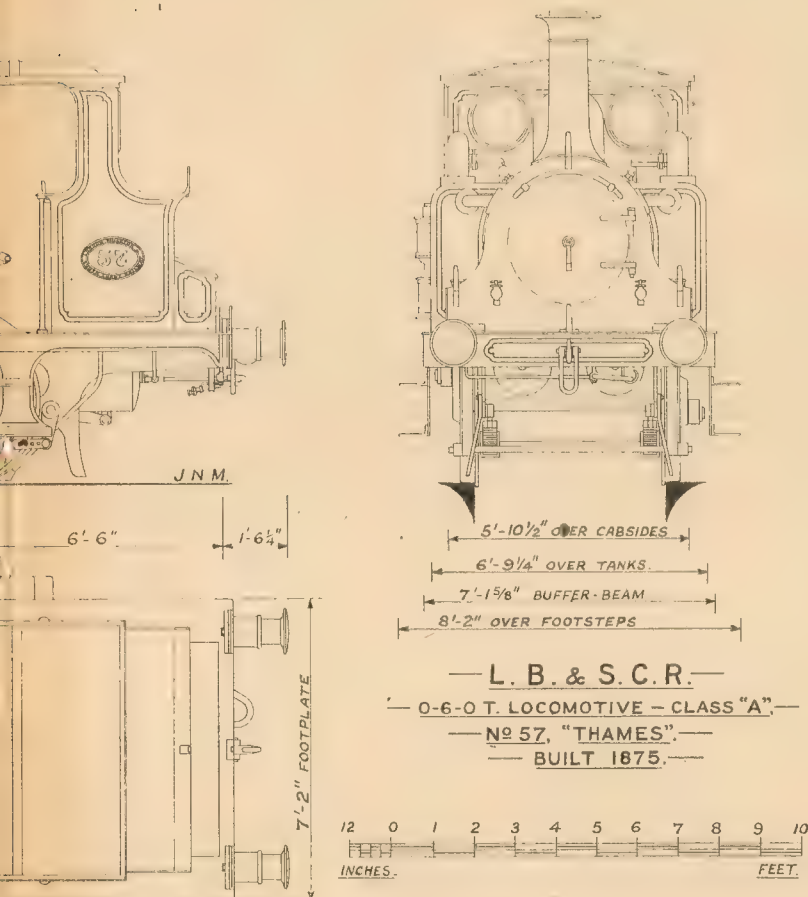
#### 1,400 miles a week

No 677 and her "balloon," at the period mentioned, was stationed at Tunbridge Wells, from which place she had a turn of duty that sent her out about 6.30 a.m. and brought her home about 10 p.m. During that time, she would cover something like 230 miles, visiting Oxted, East Grinstead, Three Bridges, Horsham and Haywards Heath in the process. In this way, she amassed a total weekly mileage of something like 1,400 miles.

To my certain knowledge, she worked this turn for three years at a stretch, and probably longer; these engines may have been small but they certainly had stamina, though the survivors now lead less strenuous lives.

It is worth mentioning that the wooden brake blocks shown in the drawing were fitted to all these engines, except the last eight which were provided with cast-iron blocks.

In later years, several of this class were sold to light railways, collieries and contractors, while two even found their way to a South American tramway. The survivors are used for locomotive shed pilot duties, shunting and such services as on the Hayling Island branch, where no heavier locomotives are permitted to run. ■



# Some facts about valve gears

**W**ELL, we live and learn! I would never have thought Mr C. G. S. Buist would have written so naive a letter [Postbag, Dec. 20] unless he was indulging in a leg-pull, or deliberately trying to revive an old controversy which I imagined was as dead as the dodo.

I have known and corresponded with Mr Buist for over a quarter of a century. I know him to be an automobile engineer of the highest order, and as a craftsman he is second to none, as his Stirling eight-footer shown at the last M.E. Exhibition readily demonstrates.

For the benefit of new readers perhaps an account of some of the experiences I have had may not come amiss, as they will settle the point raised in Mr Buist's letter.

To begin with it is a well-known fact among locomotive engineers that when a valve gear is badly worn the valve travel may be increased, not lessened. The locomotive department of the L.N.E.R. found this out to their cost, especially during the super-high-speed running which took place before the war.

The devastation among big-ends, cylinder covers, piston rods and so on, caused by the over-running of the Gresley gear, is now a matter of history. Even back in my time, on the L.B. and S.C.R. when the coal and water consumption of an engine persistently rose above normal, it was frequently found to be due to the over-running of a worn valve gear, especially with certain tank engines on some of the outer suburban services with fast timing.

## Fast work

These engines had to turn their wheels pretty quickly to keep to schedule; on the intensive services that we ran, a minute or so delay by one train would affect a whole sequence of following trains.

It wanted some doing to run the nine miles from London Bridge to Norwood Junction (first stop) in 13 min. with a nine-coach crowded evening suburban train. When the little 38-ton tank engine tore through New Cross at around 70 m.p.h. in her effort to rush the three miles of 1 in 100 up to Forest Hill, the coupling-rods were almost invisible; and the

way the valve gear was being flung about, to the full extent of any wear, was just nobody's business.

The driver notched up to the usual position on the reversing screw, but the admission was earlier and the cut-off later than he thought; consequently the fireman had to fling a few more black diamonds into the firebox and keep one eye on the water-gauge to keep the needle of the steam-gauge in the right place.

On a slow-running goods engine (nothing so common as goods engines now; freight, if you please!) the valve gear was not, of course, flung about to the extent that it would be on a fast-running passenger engine; but increase in travel would be indicated in the exhaust beats.

When notched up, instead of the usual even "whuff-whuff-whuff-whuff" per revolution of the driving-wheels, she would say "whuff-WHUFF-whuff-whuff" or "WHUFF-whuff-WHUFF-whuff" when pulling hard; and when running at medium speed on the level or downhill the beats would sound very similar to a galloping horse.

## Effect on small engines

The locomotive to which Mr Buist refers is a *Tich* with the larger boiler. I gave it the nickname of "Pimples" because our friend adorned it with innumerable dummy rivet-heads which, incidentally, is not now modern practice, welding having become the vogue. It is a first-class job, has been illustrated in these notes, and has performed in the manner usually observed among real live steamers, on my own line; once in a rainstorm.

Mr Buist states that the wear in the valve gear has converted the Curly "tram-ticket lead" into a "tram-ticket bag," which I assume is a misprint for "lag" as there is nothing baggy about my valve gears, even when worn! Well, I'm just going to deliberately and flatly contradict our friend by saying that it has done nothing of the kind; not on your life.

Mr Buist fell into the same trap that many others have fallen into before. This is what happened. He took off the steam-chest covers, turned the wheels by hand and watched the valve events. When this is done all the slackness in the valve gear must be taken up before there is any movement transmitted to the

valve; so the ports opened late and he jumped to the conclusion that there was now a lag instead of lead on dead centres.

What he entirely overlooked was that there was no pressure in the steam-chest; and when there is another factor enters which alters the complexion of events entirely—and that is steam pressure on the end of the valve spindle. With working pressure in the steam-chest the end of the spindle becomes, in effect, a tiny piston, and as the other end of the spindle is outside the steam-chest and has no counteracting pressure on it the pressure at the inner end tends to force it out of the chest.

It cannot be forced right out, owing to the valve gear being connected to the outer end, but it is forced out far enough to take up all the slack in the gear in the forward direction; and instead of there being any lag on the valve the amount of lead is actually increased to the extent of extra movement allowed by the wear.

## Cancels out

Anybody can easily confirm this by taking off the steam-chest covers of an engine with worn valve gear and turning the wheels by hand, at the same time pressing on the end of the valve spindle in the same direction as the steam would press on it. This will take up all the slack just as it is taken up under steam and it will be seen that the port opens *earlier* instead of later.

It may immediately be argued that the back port will open later, as the pressure on the end of the valve spindle remains constant; but my experience is that the earlier opening of the front port tends to cancel things out, in a manner of speaking, and there is apparently no perceptible difference in the performance of the engine.

Mr Buist states that his friend said that the running was never better. May I remind him that a motor car never gives of its best until it has done quite a lot of running and is well run-in. Same with a little locomotive. He put precision work into the job when building her; I know him too well to say otherwise—he would never tolerate a slack pin or bush anywhere. When an engine is assembled thus, it takes some little time before everything becomes quite

free, and the full power is developed at the drawbar instead of being mopped up in overcoming internal stiffness.

Incidentally I never build my own locomotives to what I call "aero limits." I tried it many years ago; when I built the first locomotive with Baker valve gear, to be exact. This was the original *Fayette*. When I fitted the pistons to the cylinders I turned them to the limits to which we worked in the munition-shop of which I had charge during the latter part of the Kaiser's war.

I had seen—and also corrected—some of the "fit-where-they-touch" variety sold commercially so thought I would try the "aero-limit" fit. The experiment was a failure, simply because the first time the engine was put in steam and the cylinders got hot the pistons expanded and seized up.

#### No micrometer needed

As my few personal friends know, I solved that spot of bother by heating both cylinders and pistons to working temperature and then turning the pistons to what I considered was the most advisable working clearance. After they had cooled off and contracted I measured the clearance, and ever since I have fitted my pistons in accordance. I have no need to use a micrometer; I use the cylinder itself as a gauge when finish-turning the piston on its own rod (held in a collet) and judge by the feel.

Same applies to valve gear. I use silver-steel pins in their natural state wherever possible, in bronze-bushed or case-hardened holes reamed to a working fit which is neither tight nor slack. I always put up a new set of cylinders and motion so that the wheels turn quite freely by hand before there is any packing on the pistons or glands. Then I know that any subsequent stiffness is due merely to packing, and that disappears after the first trial run. My own engines deliver their power *at the drawbar*!

A conclusive proof that valve travel can be appreciably increased by worn valve gear can easily be obtained by any "doubting Thomas" if he uses Roy Donaldson's test.

Rig up an improvised graph, a pencil being attached to the valve fork or crosshead with the point projecting at right angles to it, and a card attached to the running-board or frame so that the pencil point bears against it, both items of course being rigid. Turn the wheels by hand several times so that the pencil draws a line on the card, showing the extent of the valve movement.

Then change the card and give the engine a little run in steam. Comparison of the two cards will soon



*Top: Plantation locomotive No 1, LAHAINA, before rebuilding. Centre: The same locomotive after being rebuilt and, bottom: Disneyland and Santa Fe freight train. Dick Bagley is standing beside the engine*

show that steam pressure on the valve spindle, plus the over-running, has lengthened the valve travel to a considerable extent. On a small-wheeled engine such as *Tich*, hauling a single passenger, the difference in the exhaust beats would hardly be discernible.

#### Important item

On a small locomotive with inside-admission piston-valves, over-running due to worn valve gear is aided and abetted by the exhaust steam. When the cylinder-full of steam is suddenly released into the space between the end of the bobbin and the liner cover it promptly pushes the bobbin to the full extent of any slackness.

Just one more item. When I first described the two-cylinder donkey pump fitted to *Fayette* nearly 30 years ago several readers making copies of the pump left out the two valve-spindle glands at the bottom of the steam-chest, as the valve-spindles merely projected through them and were not attached to anything. They wrote and told me that they couldn't get the pumps to work.

When I asked if they had followed the instructions exactly they replied that they had left out the lower spindle glands because they did not consider them necessary. As the extended spindles did no work, they had been cut short inside the steam-chest.

That was the very reason why the pumps failed! With such tiny drilled ports, and less than  $\frac{1}{8}$  in. valve travel, it was essential that the valves should be entirely controlled by the "delayed action" drive, which was operated by a headed pin working in the hollow piston rod and transmitted by rockers.

To eliminate any interference by steam pressure acting on the valve spindles I extended them through the bottom of the steam-chest, hence the extra pair of glands. I explained this to the querists, who acknowledged that "they never thought of that," and when the extra glands were added the pumps kicked off in fine style as soon as steam was turned on.

#### A fallacy

If Mr Buist's reference to Henry Greenly is intended to imply that he considers that gentleman's "pinhole" ports and no-lead valve gears were good practice, I can soon prove otherwise. As I have explained several times, I obtained results, which Mr Greenly never thought possible, by scrapping his ideas and substituting full-size practice.

Mr Greenly stated in his articles in this journal that expansion of steam in small cylinders was pure rubbish (his own words) and his

"corrected" and other valve gears had no lap-and-lead movement. Taking his word for it I had built a little Brighton goods engine which could just keep going, using all the steam that the boiler would generate "all out." Then I thought that if lead and early cut-off produced economical running in full-size there was no valid reason, as far as I could see, why it should not do the same in the small size.

I thereupon altered my little engine accordingly, with big ports and slide-valves to suit, and a valve gear arranged for plenty of lead and early cut-off and a free exhaust which let the spent steam escape before the piston reached dead centre. The immediate and absolutely astounding result proved conclusively that it was not the expansion of steam in small cylinders that was "pure rubbish," but the theories of the gentleman whose words I quoted!

One other striking confirmation—I had a distinguished friend who, when alive, was a director of the Great Western Railway. He had some shares in a models firm which launched out after the Kaiser's war, Mr Greenly being their "consulting engineer."

This firm built 10  $2\frac{1}{2}$  in. gauge spirit-fired locomotives for my friend, to the old "standard" designs. Not one of them would maintain steam enough to haul even a small load. The sadly-disappointed owner sent one to me and asked if I could do anything with it. I fitted new valve gear with my own pet setting, bored the cylinders as big as the castings would allow, opened up the "pin-hole" ports to long slots, made fresh valves to suit, and fitted a spirit-lamp that would not boiler over. *I made no alteration whatever to the boiler, but fitted a reliable safety-valve.*

On first test the engine hauled my weight for nearly half-an-hour on one filling of water (none of the engines had pumps) maintaining full pressure with ease. Some difference!

The owner was so delighted that he asked me to give all the rest a dose of the same medicine, which I did, with the same results. He presented me with two of them. One was blown up in the big raid on Canterbury in the last war; the other went to U.S.A. and the last I heard of her, some years ago, she was still going strong, hauling long trains on a "scenic" railway.

I would suggest to Mr Buist that instead of restoring "Pimples" to the *status quo*, he removes her present cylinders and motion, fits a fresh pair of small-bore cylinders to the Greenly design, with "pinhole" ports, and a Greenly valve gear which has no provision for lap and lead; also

removes the firetube superheater and substitutes the Greenly "gridiron" in the smokebox.

Her standard of performance with these alterations will give him some food for thought. I would also suggest that he fits the engine of his Morris car with  $\frac{3}{8}$  in. valves, alters the ignition to fire on top dead centre and changes the exhaust-pipe for one  $\frac{3}{8}$  in. dia. and see if its performance is improved thereby.

#### Big "little 'uns"

Americans always have had a reputation for doing things on the grand scale and some of the locomotive enthusiasts on their side of the "big pond" have well and truly acted up to tradition, some of them even purchasing full-size old-timers and laying private tracks for them to run on.

Others have gone in for full size narrow-gaugers, Bob Day being one of them, and one of his latest acquisitions is shown here, both before and after rebuilding by Dick Bagley. She is a 2 ft 6 in. gauge plantation engine and came from Hawaii. The rebuilding has much improved her appearance as well as performance.

The two 4-4-0 engines run on Walt Disney's line in the amusement park and are replicas of 4 ft  $8\frac{1}{2}$  in. gauge engines built to 3 ft gauge, roughly five-eighths full size. They were built to pull six passenger coaches or an equivalent in freight cars, but they can deal with much greater loads. Dick Bagley, standing beside the diamond-stacker, was in charge of the building but he emphatically disclaims responsibility for the water tank! ■

#### VIRGINIA SHEETS READY

THE first three sheets of *Virginia*, the  $3\frac{1}{2}$  in. gauge old-time American locomotive, are now ready in the Percival Marshall Plans Service. The sheets are 40 in.  $\times$  28 in. and each contains a great deal of detail and cost 7s. 6d. each (\$1.50). Main contents are:

**Sheet 1:** Arrangement side view. Engine frame, truck frame. Springs, springing post. Coupled wheels, truck wheels. Axles, eccentrics. Coupling rods, crankpin.

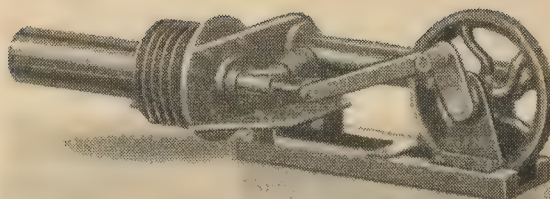
**Sheet 2:** Walschaerts gear. Cylinder. Connecting rod. Eccentric rod. Reversing shaft. Guide yoke. Eccentric strap and rod. Reversing gear details.

**Sheet 3:** Boiler. Alternative boiler. Lubricator assembly and details. Reversing gear and details. Pump cylinder.

Orders with cash should be sent to Percival Marshall Plans Service, 19-20, Noel Street, London, W.1, quoting reference LO 95.

The hot-air engine built by the author

R. F. M. WOODFORDE describes  
step by step the building of  
an elementary power unit



# An easily made HOT-AIR ENGINE

**M**OST readers will know that the hot-air engine was invented by the Rev. Robert Stirling, a Scottish minister, in the early 1800s.

The flame, or furnace, heats air in an enclosed vessel called a displacer cylinder. It has a loose fitting piston, or displacer, that moves clear of the cylinder walls. As the air expands it passes this piston and acts on a power piston in a small power cylinder reaching this through a pipe; this gives the power stroke.

The air is now cooled in the upper side of the displacer—water cooled in a large engine, but in mine cooled by means of fins, just like a motorcycle engine. The air now contracts, sucks down the power piston, and returns to the heated bottom of the displacer cylinder to be again reheated—hence no valves, no exhaust and no noise.

## Drove gunboat

Professor Rankine in *Steam Engine*, 1885, states that in a large engine average mean pressure can be 5.6 p.s.i., but, of course, a model will not reach this pressure.

He tells how an engine of 300 h.p. was fitted to an 1852 American gunboat designed by Captain Ericsson. It had four cylinders of 14 ft dia. and 6 ft stroke; it ran at 9 r.p.m. and was more economical in coal than the steam-engines of that time. What it weighed is not stated, but it was said to be too heavy for marine purposes!

It is amusing to recall a querist who, some years ago, sought in *MODEL ENGINEER* dimensions of a hot-air engine to drive his light car. As these engines are rated at 1 ton per h.p., his car would be some "light" car!

Many years ago I used to see a pair

of engines that pumped water from old Weston-super-Mare Junction to the General Weston Station, about two miles away. The supply was for locomotive boilers, etc., the local water being too hard.

These two engines, quite large ones, ran for many years and judging by the heap of burnt-out firebars outside the engine house, must have had very hot furnaces. They were replaced by oil engines later; probably hot-air engines could not be obtained.

## CONSTRUCTION

The displacer cylinder (1) is turned from a piece of iron water-pipe; it is 5 in. long  $\times$  1½ in. bore. It may be turned down on a true mandrel, or if you have not one the right size turn a piece of hardwood that is itself on a mandrel. It is turned to about 25 thou. thick at one end, the last 1½ in. slightly tapered leaving a flange about ⅝ in. at the end the full size of the tube. This taper carries the heat dissipating fins (2).

The heated end is fitted with a mild steel ½ in. cover (3) let into the bore. This must be brazed in with a high melting point spelter (low melting stuff won't last five minutes). Any metal worker will Sif-bronze it in at a small cost.

Six fins are cut from sheet or galvanised iron, ⅛ in. thick or 16-gauge. These must be turned to about 2½ in. dia. It is best to lightly sweat them together, bore them in the s.c. chuck a near fit on the tube (1). Mount them on a mandrel and turn down as stated; they can be unsweated and scraped to fit one at a time, a nice tight fit on the cylinder.

Each one may be lettered with metal stamps so as to keep the right order. In between each fin a piece of

⅜ in. brass or other metal spacer is placed. A piece of tube near-size may be sawn and closed in to suit after parting off in the lathe.

The fins are drilled with four holes each to take 4 B.A. studs. The holes are spaced to just clear the spaces. Drill one fin and use it as a template, not forgetting the stamped numbers. These six will make an assembly about 1½ in. long.

The larger end of the cylinder is fitted into a large washer (4). Cut it 2½ in. dia., ⅜ in. thick, and bore the same size as cylinder and recess the cylinder into it a nice tight fit. Four 2½ in. holes are drilled to take the studs; they can be marked off from one fin.

## Displacer piston

The displacer piston was the case of an old aluminium torch cut 2½ in. long; it is 1⅜ in. dia. and about 28 thou. thick. The heated end was stamped during manufacture, and the colder end was turned from ⅝ in. aluminium and flanged a neat fit, like (3).

Carefully chuck the tube on a mandrel and centre it true to take a ⅜ in. dia. silver-steel piston rod. This is cut say 7½ in. long (at first) and screwed ⅝ in. Whit. (or 5 B.A.). It is screwed—or four thin nuts can hold the ends in place; the holes must be central as there is no room to lose. The air space each side must be not more than ⅛ in. or 1 mm.

If obtainable, a small tin with flanged ends is highly suitable for this job. Steel electric conduit can be used, it being turned to size on a mandrel. Two ends, or covers, are turned a nice fit out of ⅛ in. mild steel and secured by four ⅝ in. thin nuts. All the joints made must be red lead

## Small hot-air engine . . .

slurried (i.e. a paste of red lead and linseed oil), or better still treated with Flexo, which can be obtained at most ironmongers.

Four 4 B.A. studs are cut and screwed  $2\frac{3}{16}$  in. long; these studs hold the whole assembly—cylinder, fins, distance pieces and washer to the angle piece of mild steel (6).

The holes to take the four studs and displacing cylinder are seen at the left and three more to take the power cylinder on the right. The sharp angles may be cut away if required. The plan shows four holes to take  $\frac{3}{16}$  in. bolts or studs to secure the angle to the base. This angle piece is of mild steel 5 in.  $\times$   $1\frac{3}{4}$  in.  $\times$   $\frac{1}{8}$  in.

### The gland

The gland (7) which takes the displacer piston is turned from a piece of good brass; it can be drilled, reamed and turned at one operation in the s.c. chuck. Make it at least  $1\frac{1}{2}$  in. long; the disc end may be  $\frac{3}{8}$  in. dia.,  $3/32$  in. thick. The screwed part is turned  $21/64$  in., that is if you used a  $\frac{1}{8}$  in. gas die (28 threads) to screw it, otherwise it must be turned to suit your handiest die. The small part is turned to clear the die.

It is highly important that this gland is true all over. It can be drilled with a No 31 drill, though  $7/64$  in. can be used. If you do not possess a  $\frac{1}{8}$  in. reamer, one is easily made from a piece of  $\frac{1}{8}$  in. silver steel. It is filed away from  $\frac{3}{8}$  in. to  $\frac{1}{8}$  in. dia., i.e. made into a D-drill. Do up the cutting edges on an oilstone, dead harden it vertically (bright red into water, or it may warp) and temper it in water (medium straw colour) also held vertically. This ought to make a nice smooth true hole.

The piston rod must be a nice fit, no stiffness in motion and no appreciable side shake. The gland is held in place by a  $\frac{1}{4}$  in. brass nut tapped  $\frac{1}{8}$  in. gas; it may be  $\frac{1}{2}$  in. thick. A piece of brass is cut  $1\frac{3}{8}$  in.  $\times$   $\frac{7}{8}$  in.  $\times$   $\frac{3}{16}$  in. (8). It is drilled a good fit to take the screwed part of the gland and a hole  $21/64$  in. to tap  $\frac{1}{8}$  in. gas to take a  $\frac{3}{8}$  in. copper pipe; the tapped end is also secured to the steel angle by means of a 4 B.A. screw. The larger hole takes the gland and holds the brass piece in place.

It is very important that this hole is central with the cylinder. The surest way to do this is to turn a piece of hardwood to fit tightly in the washer. It is turned on a  $\frac{3}{8}$  in. mandrel. The washer is now laid in place, the four stud holes are marked off and drilled, the studs put tempor-

arily in place, and the angle piece drilled to take the gland. Put all in place and the piston should be clear to move without rubbing the cylinder walls.

### Flywheel

The flywheel used in my engine was an old gearwheel, originally part of a hand drill. It is  $3\frac{1}{2}$  in. dia.,  $\frac{7}{16}$  in. deep in the rim and  $\frac{1}{2}$  in. wide. The centre hole was bushed (10) (a turned brass bush) the larger part being made like a V-pulley; it must be a press fit in the pulley. A larger flywheel would be better, but it would need higher bearing pedestals. The hole that was used for the handle is useful to hold a balance weight which will be needed as the cranks are well out of balance.

The spindle is  $\frac{3}{16}$  in. mild steel, but do not cut it until the length is known.

The bearing pedestals are cut from the same steel angle that No 6 is made from; No 11 shows one. They are  $1\frac{1}{2}$  in. wide at the bottom end, the foot is  $\frac{1}{2}$  in. wide, drilled to take two 4 B.A. screws, the top is drilled and tapped  $\frac{1}{8}$  in. gas to take a bush—centre to base  $1\frac{3}{8}$  in. Two are wanted.

Three bushes are turned of good brass  $\frac{3}{8}$  in. dia. screwed  $\frac{1}{8}$  in. gas and about  $\frac{1}{2}$  in. to  $\frac{3}{8}$  in. wide. These screw into the pedestal and are locked by thin nuts; one of the three is used to make the big-end of the power connecting-rod. This last bush is held in place by two thin nuts; the bushes are  $\frac{3}{16}$  in. fit to the shaft.

### Base

The base is two  $\frac{1}{2}$  in. square mild steel rods  $6\frac{1}{2}$  in. long; the pedestals are held  $\frac{1}{4}$  in. from one end by four 4 B.A. screws. There is no need to tap right through the  $\frac{1}{2}$  in. mild steel—I suggest only halfway, and using a clearing drill halfway. These two base rods are tapped  $\frac{3}{16}$  in. Whit, to take the angle piece (6), say  $\frac{7}{8}$  in. centres allowing  $\frac{1}{2}$  in. at the ends.

Now to erect the pedestals, bushes, shaft and cylinder assembly in place. Four  $\frac{3}{16}$  in. studs are tapped in place, and four brass or mild steel packing pieces are drilled and turned to make the centre of piston rod, the same as the shaft; these may be turned about  $\frac{7}{16}$  in., drilled  $\frac{3}{16}$  in. clear and will likely be  $\frac{7}{16}$  in. high.

A steel piece is needed to strengthen the base (33). It should be about  $\frac{1}{2}$  in.  $\times$   $\frac{1}{16}$  in. (Leave tapping and drilling till later.)

For the displacer connecting-rod (15) cut two strips of mild steel or brass  $3\frac{1}{2}$  in. long  $\times$   $\frac{3}{8}$  in., tapered to  $\frac{1}{4}$  in.  $\times$   $3/64$  in. thick; the small ends

drilled  $\frac{1}{8}$  in., big-ends  $\frac{1}{4}$  in. A brass bush is turned  $\frac{3}{16}$  in. bore and  $\frac{9}{16}$  in. wide ends are turned down to fit the  $\frac{1}{4}$  in. holes in strips. The bush is shown (16); it is sweated in place.

The cross-head (18) is brass; it is  $\frac{1}{2}$  in. dia. and  $\frac{1}{2}$  in. long and is drilled  $\frac{1}{8}$  in. to take the piston rod; two  $\frac{1}{4}$  in. screws are tapped in halfway at opposite sides; these grip the piston rod and act as pivots. The stroke of the displacer piston is now measured; it must clear each end of the cylinder when in place by  $\frac{1}{16}$  in.; in my case it is  $1\frac{1}{4}$  in. stroke.

### Crank throw

The displacer crank (20) throw must obviously be half this, i.e.  $\frac{7}{8}$  in. The boss of brass is  $\frac{3}{8}$  in. dia., bored  $\frac{3}{16}$  in. It is  $\frac{1}{2}$  in. wide, one end turned to  $\frac{3}{8}$  in. dia.,  $\frac{1}{8}$  in. wide and sweated into a brass piece  $\frac{3}{4}$  in. wide tapering to  $\frac{1}{2}$  in. The hole for the crankpin is tapped  $\frac{3}{16}$  in. for a mild steel pin  $\frac{3}{8}$  in. long (a tight fit). A 4 B.A. screw into the boss secures it to the shaft.

The power cylinder crank is like (20) but it is not made until its throw is known. A temporary one is made roughly.

The power cylinder (22) is a brass tube  $2\frac{1}{2}$  in. long  $\times$   $\frac{3}{4}$  in. bore. It is sweated into a brass cover turned to  $1\frac{1}{4}$  in. dia.  $\times$   $\frac{1}{4}$  in. or  $\frac{3}{16}$  in. thick, recessed (like No 3). The cylinder may be about  $\frac{1}{16}$  in. thick.

The power piston (24) is of brass  $1\frac{1}{2}$  in. long, about  $\frac{1}{16}$  in. thick, the end being sweated in. A central hole  $\frac{3}{16}$  in. is drilled in the end before it is sweated in. This piston is turned a tight fit into the cylinder. It has then the end sweated on and is mounted on a  $\frac{3}{16}$  in. stud or long bolt. Two nuts hold the piston. It must be an excellent fit in the cylinder bore. This is most important.

Sharpen your wood chisels on a nice fine oil stone. Take the oily mixture thus made and smear it on the piston and work the piston in and out of the bore, repeating the mixture until a superb fit and finish are secured. It is not a lengthy job. Work it, turning it now and then in the bore, until when cleaned it will just slide through by its own weight. All this mixture must be well cleaned away with petrol.

A small brass circular, or square, block (23) is sweated on to the bottom end of the cylinder. It can be  $\frac{1}{2}$  in. round or square and it is tapped  $\frac{1}{8}$  in. gas; it is  $\frac{3}{8}$  in. thick and filed to fit on to the cylinder. Sweat it in place the same time as the brass cover is sweated on. A good tip is to wire it in place with a rusty wire until both are secure.

The cylinder end is drilled and tapped in three places (i.e. 120 deg.) and secured to the angle piece (6) by

three 4 B.A. screws; these holes are marked off in the angle piece after the temporary power crank and connecting-rod have been made and tried in place.

The gudgeon pin may be mild steel or brass; it is held to the piston end by means of a  $\frac{3}{8}$  in. countersunk screw and thin nut; the actual pin is  $\frac{1}{8}$  in. mild steel and just fits easily into the piston bore.

The block (23) when in place must have a drill put through the cylinder; drill  $\frac{5}{16}$  in.—any roughness or burr inside must be very carefully removed with a small half-round scraper.

The power connecting-rod (30) must at first be a rough temporary one; any metal will do. It is drilled at the small end  $\frac{1}{8}$  in. and slotted to take the bush. This and the temporary crank (21) can be adjusted to give a stroke to the power piston of anything from  $1\frac{1}{2}$  in. down to  $\frac{1}{4}$  in.

The power crankpin (26) is of  $\frac{3}{16}$  in. mild steel. It is held by two thin nuts into a slot in (21).

Copper tubes (27 and 28) are  $\frac{3}{8}$  in. dia. One is bent at small radius and screwed into the block (8). It must be red heated, cooled in water to anneal it, then filled with lead or solder and it can then be bent in a piece of hardwood held in the vice. One is screwed into the cylinder block.

A hole must be drilled through the angle piece just where the bent pipe is connected; it may be  $\frac{5}{16}$  in., or if there is not much room, two or three smaller holes. The 4 B.A. screw is tapped into the angle piece. If this screw is omitted an air leak is sure to occur. A real engineering job is made if these tubes are joined by means of a screwed running coupling and two thin lock nuts, but a rubber tube, or better still some modern

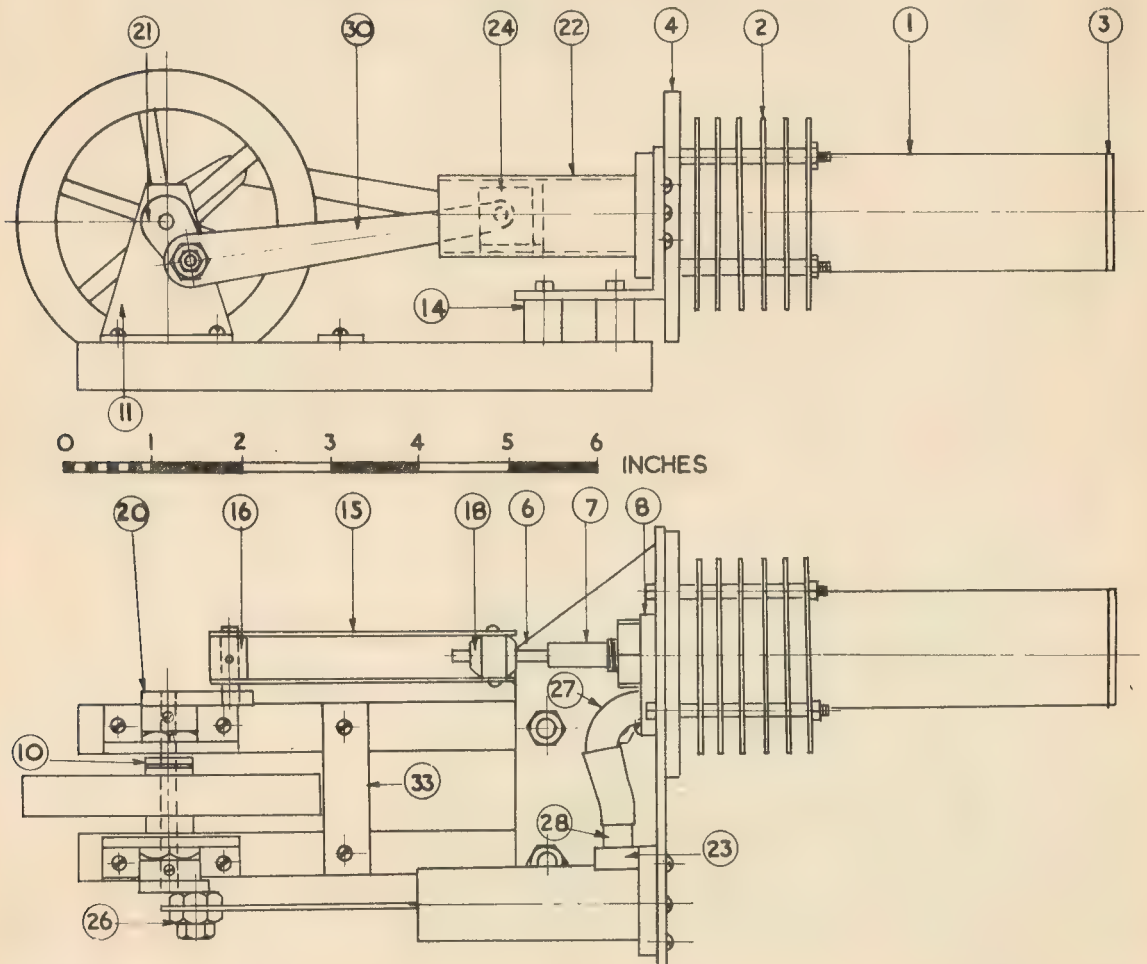
flexible tube, makes a good job, as the aligning of the two pipes is not very easy.

## TEST

All may now be put in place—all joints being made with red lead or Flexo; a paper joint (blue sugar paper is good), well varnished, is put between the washer (4) and angle piece (6). It is well to make an air leak test by immersing the cylinder end in a bucket or pan of water and blowing through a rubber pipe attached to the bent pipe. Tiny bubbles from the gland are allowable if they are tiny bubbles. The whole motion should turn very easily; if not the cause must be found and remedied.

The flywheel is held on the shaft by a 4 B.A. screw. A small spirit lamp can be used to heat the air, or a very small bunsen gas burner. The cranks are set at right angles so the

Side elevation and plan of the engine described in the text



## Hot-air engine . . .

engine should start in a minute or so. It is not self starting. My own engine reaches over 500 r.p.m.

The crank throw of the power cylinder must be tried at several lengths, and the best one noted. After this the permanent crank and permanent power connecting rod are made. The rod is of aluminium  $\frac{1}{2}$  in. wide at the big-end and  $\frac{5}{16}$  in. at the gudgeon end. It has  $\frac{1}{16}$  in. thick bush. It is a small bush, only  $\frac{1}{8}$  in. bore, about 1 or 2 B.A. held by two very thin nuts. It may be necessary to file two pieces out of the power connecting

rod with a half-round file. It all depends on the crank throw.

Some engines run better when the cranks are set somewhere between 80 and 90 deg. instead of at right angles. If turned at right angles in the other way of rotation, the engine can be reversed. When the best positions of parts is obtained, the screws should be sharpened at their points and a small V-hole drilled in the shaft to secure these positions.

As the cranks, etc., are at odd angles, the engine will likely "waltz" about under speed. This can be corrected by means of a small weight placed on the rim of the flywheel. My own is about  $\frac{1}{4}$  oz.

Anyone preferring a wood base

can use a good well-seasoned piece in place of the steel pieces. They will probably have to cut a wheel race to take the flywheel.

This engine can be built in varying sizes but don't forget the temporary crank and connecting rod test. The engine looks well if the displacer part is painted with motorcycle cylinder paint, iron parts red or green and brass parts polished.

A furnace can be made out of sheet or galvanised iron 16- or 18-gauge. It can be circular or square, riveted up and preferably asbestos lined. A clear hole is cut to admit the heated end of the displacer.

The writer will be pleased to answer queries through the usual channels. ■

## More models at Manchester

By Northerner

MODEL ENGINEERING was a prominent feature of the *Daily Sketch* Home and Handicrafts Exhibition held at Manchester.

The Northern Association of Model Engineers was asked to organise this section of the show and a very fine display was the result—though it would have been even better with more space available.

In the General section, first prize was awarded to J. Marsden of Blackburn for a beautifully made and finished milling machine. This was mostly fabricated from mild steel sections, dowelled and screwed together before machining.

Second prize in this section was awarded to a neat compound marine engine built by E. B. Wilcox to his own design, though it followed accepted marine practice throughout. Mr Wilcox won the Championship Cup at the Model Engineer Exhibition two or three years ago with his triple expansion marine engine.

Two more "general" models particularly caught my eye among the many present. One was a lovely little solid model of the Fowler B.6 compound road locomotive No 16263 *Talisman*. Built to a scale of  $\frac{3}{8}$  in. to 1 ft by A. McMillan of Liverpool the model was only  $7\frac{1}{2}$  in. long and  $4\frac{1}{2}$  in. to the chimney top, but it contained a

wealth of accurate detail.

Finish was excellent, but was marred by one unfortunate error; the smokebox door should be of polished iron, not brass.

An entirely different mode of transport was the Shropshire farm wagon modelled by P. Knipe, chiefly in oak which was left natural colour. Fifteen inches long, the model was most attractive, though lacking somewhat in perfection of finish.

Among the locomotives were several old friends, the first prize winner being E. F. Holden's magnificent Aspinall Atlantic of the Lancs and Yorks Railway. Third was the Green Arrow, built by D. W. Horsfall of Brighouse.

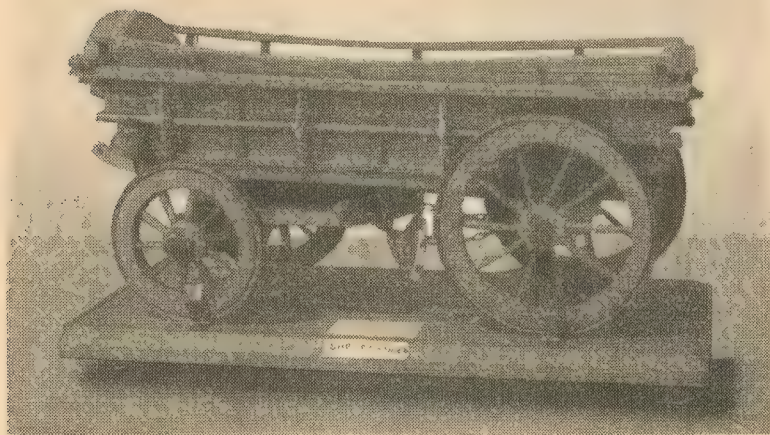
Second prize was awarded to V. Beswick, of New Moston, for his  $3\frac{1}{2}$  in. gauge Princess Royal, which I had not seen before. It was well finished as to machining, but the "Midland red" paint had rather too matt a finish for true realism. Working vacuum brakes were fitted and the tender had a water pick-up. The wealth of detail, all adding to the appearance, included hundreds of rivets, and a well-fitted footplate had lockers and tip-up seats.

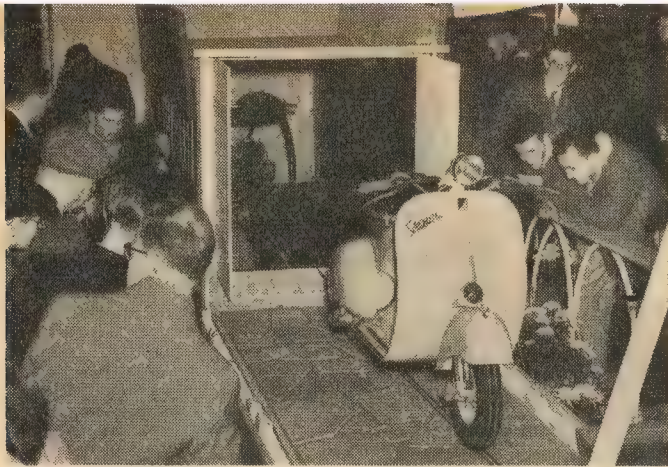
### Radio-controlled models

Besides the N.A.M.E. stand, the Manchester group of the International Radio-Controlled Models Society had a display which was a big source of interest to visitors. A small tank was used to demonstrate the control of boats, with balloon-bursting a popular feature.

Prominent on the stand was an impressive model of R.M.S. *Edinburgh Castle*, with hull 7 ft 9 in. long overall, built of Lagos mahogany on the vertical bread-and-butter pattern. Motive power was a 24 v. electric motor driving twin  $2\frac{1}{2}$  in. propellers through a 3 to 1 reduction gearbox. ■

*P. Knipe's attractive and unusual model of a Shropshire farm cart was made mainly from oak*





# Vulcan on two wheels

*The Douglas Vespa scooter doing its tight-rope act. How this was done was one of the major talking points at Earls Court. ("The Motor Cycle" picture)*

## Our contributor gives his views on the Motor Cycle Show

**P**ERHAPS as I grow older I become more blasé, but I was disappointed with the last Motor Cycle Show at Earls Court.

Somehow the sparkle and enthusiasm of previous exhibitions were missing and although I would be the first to agree that it was I who was out of step, my companion (a very enthusiastic rider) echoed my thoughts before I had said anything.

There was little new at the show—at least from the home factories. Continental manufacturers were present in a fair degree of force and some of their exhibits were outstanding both from a technical viewpoint and sales appeal.

The modern Italian or German lightweight motorcycle is a very good machine indeed; a number of their scooters are equally good, but some makers have tried too hard to combine eye-appeal, feminine-appeal and every other appeal. The result is often a mildly-alarming vehicle, tremendously exciting from an academic point of view, but one that raises cries of fear from the realists visualising the damage that could be caused to expensive panelling following a toss in Birmingham's Bull Ring on a wet day.

Mind you, I think the scooters have developed wildly to the other extreme imagined by the pioneers of Vespa and Lambretta.

In the early post-war years these two excellent machines were simple little jobs that transported their riders at a minimum cost for an indefinite period. These same machines still follow that admirable precept for the most part, but there are many others with electric starters, self-change gears, radio and other mod. con. that bring prices up to car levels.

Besides the extra initial cost, running expenses are inflated. Weight goes up, fuel consumption goes up as larger engines to deal with the increased load are fitted, and insurance and tyre costs are increased. Inevitably the super-scooter will become extinct through sheer size in exactly the same way as the dinosaur did.

From these remarks you may gather that I view scooters with a rather jaundiced eye—and how right you are. My affections are all for the motorcycle proper. A motorcycle with a big engine, vivid performance and few pretensions to car comfort, weather protection and the other clichés some manufacturers

use to appeal to "fringe" riders—those who would prefer a car, but cannot quite afford the running cost.

One of the most fascinating sights for my money was the selection of part-sectioned machinery. B.S.A., who do this part-sectioning very well, had a 500 c.c. *Shooting Star* with its engine, transmission, suspension, ignition, fuel supply and lighting gear cut away to show the working arrangements.

Apart from the admiration of sectioning as a piece of work, I always think that one can learn more about an engine by this method than any other. Particularly in the case of the B.S.A. twins, which have a rather tricky valve and pushrod layout, the man who does his own servicing can save himself an immense amount of trouble by carefully watching a part-sectioned engine in action.

Do not think I am carrying a torch for B.S.A., but they certainly seem to go out of their way to help their customers. On their service stand, there were dozens of part-sectioned items from the entire range and enormous drawings of motorcycle components were hung on the walls.

The Auto-Cycle Union had a display of model motorcycles—most of which have graced the M.E. Exhibition in the past three years—and although the models were, for the most part, very well done, they were hopelessly overshadowed by the full-size exhibits. The R.A.C. had a few old-time machines (I purposely refrain from writing vintage or veteran, because there is almost certain to be a motorcycle there that does not come in either of these categories!) and my heart bled for the heroes who had to ride them—this in spite of my earlier scornful remarks about weather protection!

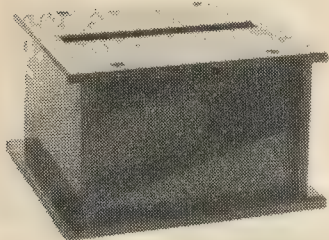
Bicycles, I am afraid, leave me unmoved. No matter how light they are and no matter what superb change-speed gears they possess, you still have to pedal them and it is at this point that I lose interest.

However, on an accessory stand in the gallery there was an immensely interesting group of old machines which showed the evolution of the bicycle.

Once again, the sight of these old monsters inevitably raises the mental thought—are we the men our grandfathers were? If a 1957 cyclist were told to ride any of these machines (other than for fun) you would hear roars of protest four streets away. ▣

DUPLEX describes a useful adjunct to the home workshop

## A bench saw table



Above, Fig. 1: An example of work machined by means of the saw table

THE CIGARETTE MACHINE (Fig. 1) shows how, when making articles of this kind, time and labour can be saved by cutting up the various component parts to the exact finished size, thus eliminating tedious hand work.

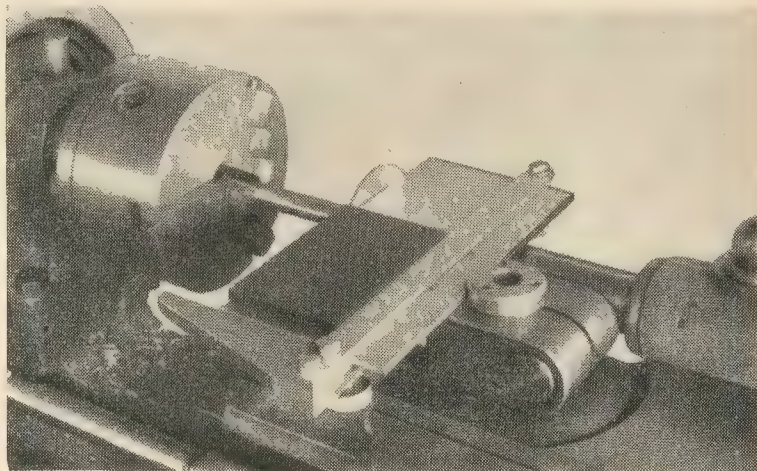
Perspex sheet  $\frac{1}{8}$  in.,  $\frac{3}{16}$  in., and  $\frac{3}{4}$  in. thick was used and after the parts had been sawn to size the cut edges were polished to match the rest of the plastic material.

or holes are being drilled and tapped for fitting assembly screws.

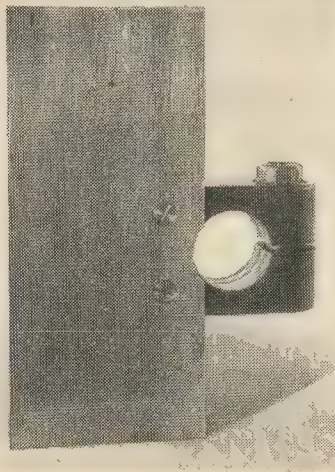
### THE SAW TABLE

In the present instance the work table was made only 3 in. wide as this was ample for dealing with the plastic material used, but where necessary the width of the table can be increased to accommodate larger work. Mild-steel plate,  $\frac{1}{8}$  in. thick, was used for making the table, although for greater rigidity thicker material

Right, Fig. 2: The set-up in the lathe for cutting out sheet material



Below, Fig. 3: Showing the saw table attached to the Norman toolholder



The machining was carried out (Fig. 2) by means of a circular slitting saw mounted in the lathe and with the work supported on a small sawing table attached to the lathe toolpost. The addition of the guide fence enables the plastic material to be cut to an exact width and with its cut edges truly square and parallel.

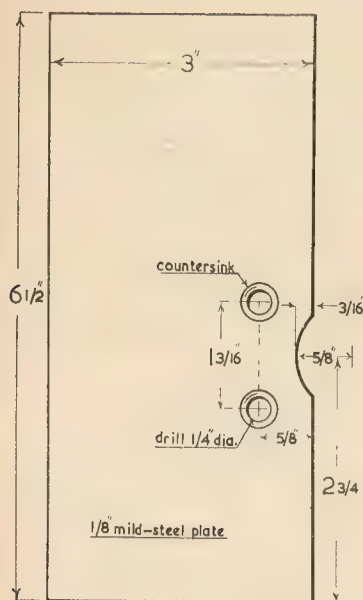
Cutting the material to square the ends of the work can be readily done by clamping the parts to the saw table and feeding the work to the saw by means of the lathe cross-slide.

A further advantage of using this method to ensure that the edges of the work are cut squarely is that where the parts are cemented together there is no danger of distortion when clamps are applied to hold the parts firmly in position while the cement is setting

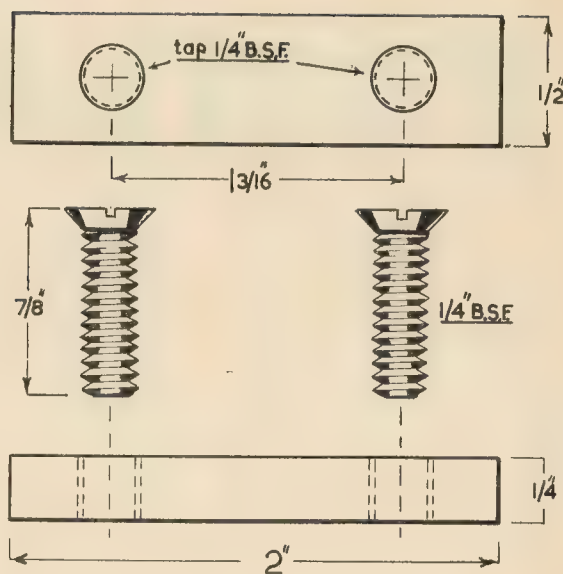
is advisable where a larger table is fitted.

An additional means of bracing the table is to use a jack-screw resting on the lathe bed, supporting the overhanging portion of the table from below. The Drummond lathe has the advantage that the Norman toolholder which is the standard fitting provides a convenient form of mounting for the work table; but other types of toolholders (including four-tool turrets) may serve equally well although they do not usually afford a means of height adjustment except by the use of packing strips.

A crescent-shaped cut-out is formed in the edge of the table to increase the width of the bolting face to  $1\frac{1}{2}$  in. and also to allow the toolholder to be lowered on the topslide toolpost to



Left, Fig. 4: The dimension of the sawing table



Right, Fig. 5: The bar for clamping the saw table in position

adjust the depth of engagement of the saw.

With a circular saw,  $2\frac{1}{2}$  in. dia., the table can be raised to full height to enable larger sheets of material to be cut up by working to a scribed line but where the fence illustrated is used in conjunction with a table of 3 in. width,  $2\frac{1}{2}$  in. is the maximum width of material that can be sawn.

It is essential to file or machine the front and left-hand edges of the table straight and exactly square with one another, for these are used as datum surfaces when setting the table square to the lathe axis and adjusting the position of the fence to determine the exact width of the finished work. For securing the saw table to the Norman toolholder the fitting illustrated (Fig. 5) is made from  $\frac{1}{2}$  in.  $\times$   $\frac{1}{4}$  in. mild-steel strip.

This bar, which fits into the slot in the toolholder, is tapped  $\frac{1}{4}$  in. B.S.F. to receive the two countersunk attachment screws that have their heads fitted flush with the table surface. By locating these screws on centres  $1\frac{3}{16}$  in. apart they will pass through the holes tapped in the toolholder for the standard clamping screws.

### SLITTING SAWS

Several makes of circular slitting saws are obtainable with teeth suitable for cutting wood, metal, and plastic material. These are made of either carbon steel or the high-speed alloy and are preferably hollow-ground to afford adequate clearance when taking deep cuts.

British saws are listed from 1/32 in.

to  $\frac{1}{8}$  in. or more in thickness and from  $1\frac{1}{2}$  in. to upwards of 6 in. dia., and those of Continental manufacture are obtainable in thicknesses of from 0.2 mm., or 8 thou., to 3 mm. and with diameters of from approximately  $\frac{3}{4}$  in. to 4 in. Another type of fine-tooth circular saw is made for slotting screw heads. These have thicknesses of from 6 thou. to 57 thou. and overall diameters of from  $1\frac{1}{4}$  in. to  $2\frac{1}{4}$  in. Saws of this kind when not hollow-ground are less suitable for deep cutting.

If a circular saw is to cut efficiently it must be mounted to run truly in both the axial and radial directions, because if the saw wobbles it will cut a kerf wider than the tooth thickness, and eccentric running will cause the cutting load to fall on some of the teeth only, with consequent risk of tooth breakage. It is essential, therefore, where material overhang is present, to clamp the saw in place on an accurately machined arbor that is supported by the lathe tailstock centre.

It will be noted that the arbor is shown gripped at one end in the self-centring chuck and with the other end engaged with the tailstock centre. This arrangement is in order because the chuck illustrated grips truly on this diameter, but as a rule it is important to mount the saw arbor between the lathe centres and drive it by means of a carrier from the dog of the mandrel driver-plate.

When cutting up Perspex material of  $\frac{1}{8}$  in. to  $\frac{3}{8}$  in. thickness it was found that a suitable saw for the purpose

was a fine-tooth, hollow-ground carbon steel variety, but a high-speed steel saw would have stronger teeth and would retain its sharpness for a longer period. The thickness of the saw used was 1 mm. or 24 thou. and it had a diameter of  $2\frac{1}{2}$  in., but a rather larger saw would be preferable for cutting the thicker Perspex or where the table has to be raised to accommodate larger sheets of material.

With the lathe running at 400 r.p.m. the saw cut very quickly and with the aid of the fence a perfectly straight line was maintained; moreover, under these conditions there was no appreciable heating of the saw or the work and no lubrication was required to obtain a highly-finished surface on the cut edges.

● To be concluded.

### HISTORIC LOCO MODELS

*Locomotives Worth Modelling*, by F. C. Hambleton, gives descriptions of many famous engines of the pre-grouping period including: the old Midland No 1447; London and South Western No 591; London Chatham and Dover No 145; the famous Great Northern Number One; and the Manchester, Sheffield, and Lincolnshire No 694.

Lavishly illustrated throughout its 176 pages with detailed drawings it is obtainable from Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1, price 10s. 6d., postage 8d. (U.S.A. and Canada \$2.50).

# POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

## ON THE K. AND E.S.R.

SIR,—The article on the Kent and East Sussex railway [MODEL ENGINEER, December 20] recalled some pleasant memories for me.

During the last war I was in the R.E.s and I was one of a detachment of a Railway Transportation Coy attached to a Super Heavy Battery of the R.A. consisting of a 9.2 in. gun and 12 in. howitzer, both on railway mountings. We were attached for transporting these guns which we did with one of the ex-G.W.R. Dean 0-6-0s.

In the beginning of 1941 we were moved to Rolvenden in Kent, which proved to be the locomotive department of the Kent and East Sussex Rly. An R.E. construction unit first had to lay some sidings in the yard consisting of the properly chaired track, the huge guns would never have remained two minutes on the K. and E.S. track.

The first few weeks proved to be very busy ones for us because during the first few days our engines became derailed owing to the rails spreading, the siding where the engine was stalled not having been relaid. These derailments became very numerous and we became expert in getting our engine back on the rails again with the aid of special ramps carried on the back of the tenders.

In a dilapidated shed which served as the "shops" I remember two relics which were in for breaking up. One had all the trade marks of a former G.W. engine. It was a tiny saddle tank bearing the name *Tre-Pol-Pen* and it had the usual copper funnel, brass dome, etc. These were duly broken up by the one and only fitter assisted by several of us.

The old fitter was a masterpiece. Assisted by only a young lad he would strip an engine down to the last nut and bolt and rebuild it into an almost new engine.

When due for washing out, our engine used to double-head the 8 a.m. to Headcorn and from there it went by S.R. main line to Ashford shed. We would put the engine away ourselves and spend the night in a camp coach at the rear of the shed. Next morning we would wash her out, light her up and when in steam travel light to Headcorn again and double head the 5.15 p.m. back to Rolvenden—after a warning by the K. and E. Sussex driver not to go too fast!

On hop picking days, out would come their pride and joy, which was a six-wheeled coupled tender engine built by Neilson's of Glasgow. This was the only time this engine was used.

I also remember the first time the guns were fired (three rounds practice). Firing broadside on to the track the blast took the roof off the carriage shops and collapsed a platelayers' hut which stood below and in front of the gun muzzle. The two drivers of the railway, Nelson Wood and Jim Webb, became our firm friends. I expect they have long retired but I hope that should they chance to read this it will bring back to them as many pleasant memories as it has to me.

Oxford.

C. G. TURNER.

## SPRING MAKING

SIR,—I have made my own springs for years, using up all old springs for other requirements, compression or tension.

A vice and two pieces of hardwood are required about the size of the vice jaws, also a rod of mild steel the diameter of which should be  $\frac{1}{8}$  in. less than the inside of the spring to be made.

A hole is drilled 1 in. in, the drill size being determined by the gauge of the old spring. It should be a loose fit.

Bend the other end of the rod at right angles to form a turning handle when clamped in the vice.

Put the hardwood in the vice with the rod between the hole facing upwards. Put the end of the old spring in the hole in the rod and turn slowly. This method makes the perfect spring in safety.

Leicester.

J. WHITE.

## THAT BLUE FLASH

SIR,—I was interested to read Mr E. C. Wright's statement [Postbag, December 27] that discarded radio valves gave a blue flash when broken in a dustbin.

May I offer the following suggestion for the reason for this? I believe that in the final stage of exhausting radio valves use is made of a piece of phosphorous as the final getter. Is it possible that the phosphorous remains in the tube in a very finely sub-divided state and on coming into contact with the oxygen of the air ignites spontaneously?

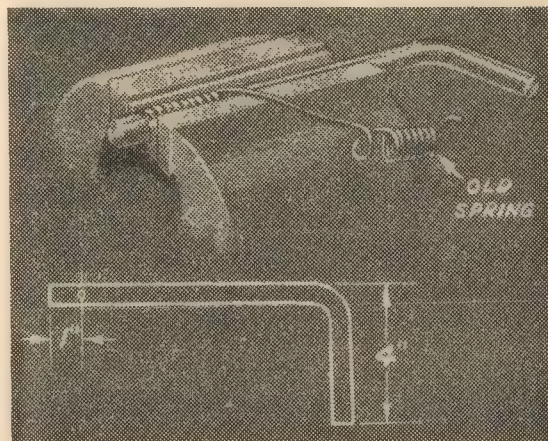
Enfield, Middx.

J. W. COOPER.

## SHARPENING A MOWER

SIR,—With reference to the reply to the query by H.A.F., Harwich [Queries, December 27], I am open to correction, but I was under the impression that lawn-mower cutting cylinders should have the blades sharpened so that each blade has a positive rake (the edge lying at the greatest diameter being the leading edge when rotating) and not so that each blade edge merely forms an arc of the circumference of a cylinder,

Details of Mr White's jig for re-winding old springs



which will be the result if grinding is carried out according to the instructions given.

Some years ago you published an article on the subject. The mower cylinder was ground in an arc of rotation to maintain the blade setting at the correct angle to the toolpost grinder. This was done by a finger which rotated the cylinder as the saddle moved along the bed and each blade was done separately.

The lathe was also given false centres for the job to enable it to carry a cylinder otherwise too big for the lathe used.

This rig worked very well—I used it, and still do.  
Kent.

K. STOCKER.

SIR,—I would suggest H.A.F., Harwich, turns to Vol. 112 page 475 of *MODEL ENGINEER* where he will see a suitable set-up for lawn-mower grinding.

Unless H.A.F.'s cylinder is of very small diameter or he has a larger lathe than most of us, rotating between lathe centres will present a difficulty. Although grinding between centres with cylinder revolving may prove O.K. commercially, the home-worker will find the intermittent contact between blades and grinding wheel is liable to produce vibration and not so satisfactory results.

I have found that grinding each blade separately is the best answer, as by this method "relief" can be given to each blade by setting the cylinder just above the centre line of the grinding wheel, using a follower under the blade, which is kept in contact by passing a line round the cylinder—missing the blade being ground and attaching a weight to the end of same. Do not be impatient, take light cuts and hand feed.  
King's Lynn.

JOHN D. ELAM.

## RANSOME RESTORED

SIR,—I am sure a lot of steam enthusiasts will be pleased to hear of another engine back on the road again.

Two steam fans and I, as well as the owner, Mr Foster, of Woodborough, Notts, set about the job of restoring it.

We drove eight miles to Gunthorpe with no trouble, and the next weekend it was doing a rough job hedge pulling. It is now at Gunthorpe which will be its home for the time being.

Gunthorpe, Notts.

J. PROCTER.

## CAR LIGHTING

SIR,—Recently I repaired a fault on the electrical system of a motor-cycle which had the normal size accumulator; but the generator was

an alternator feeding the battery through a rectifier.

This was a sensible idea for there could be no trouble from brushes or cut-out; in fact, nothing to give trouble as far as working parts were concerned.

I wonder why car manufacturers have not adopted this method. With an alternator nothing much can go wrong for the winding is a fixture and there are no loose contacts. The fact that a dynamo floats on the battery would make no difference.

Enfield, Middx.

J.W.C.

## TURNING A TAPER

SIR,—Being a turner by trade and having done quite a lot of taper turning I wish to add something to the instructions given by Geometer on taper turning [December 20].

Owing to the fact that any alteration in the height of a tool will alter the angle of the taper the machine should be set up in the following way.

The tool and the d.t.i. should be set up in the four-tool turret and set to height using a centre in the headstock, the point of the tool being set to the point of the centre and the same done with the d.t.i., as in diagram.

Since any variation in height of the tool alters the taper, the same would happen if the d.t.i. was at a different height to the tool: you would not get a correct reading.

After setting up in this manner Geometer's instructions can be carried out.

Cumberland.

R. M. McDONALD.

## CLOCK SPRINGS

SIR,—Spring steel  $\frac{1}{8}$  in.  $\times$  0.008 in. can be obtained from most tool dealers as feeler gauge strip (Moore and Wright No 126) by  $\frac{1}{8}$  in.  $\times$  12 in. lengths. It is supplied in sizes  $1\frac{1}{2}$  thou to 25 thou.

This seems very good steel for the purpose, as this pendulum is no light weight when completed. I have made mine and used this steel.

Hainton, Lincoln.

TOOLRACK.

## ARTICULATED LOCOS

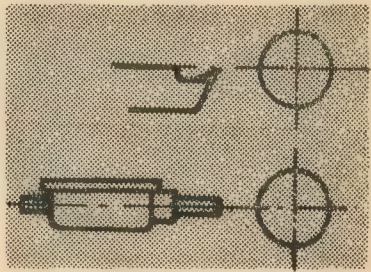
SIR,—I was very interested in "Unusual Locomotives No 6" [*MODEL ENGINEER*, December 27] as it is 36 years since I first became acquainted with the Fairlie locomotive.

These were metre gauge 0-6-6-0 with two separate boilers. They worked the ghat section between Sedaw and Maymyo in Burma. Their four cylinders were 14 in.  $\times$  20 in., coupled wheels 3 ft 3 in., and working pressure 150 lb.

This section of line consisted of  $11\frac{1}{2}$  miles of 1 in 25 grade with four

reversing stations, followed by 15 miles of 1 in 40. Their rated load was 125 tons on 1 in 25 for one engine, or 240 tons with two engines, one at the head of the train and the other pushing. Their progress up the 1 in 25 grade (uncompensated for curvature and equivalent to about 1 in 21.4) was very slow, and the engines disappeared in a cloud of steam.

The steam and exhaust pipes, which



*The method Mr McDonald employs for accurately turning a taper*

each had one sliding and two ball joints to allow for considerable movement, were very inaccessible and extremely difficult to keep tight.

The Fairlies were terrific coal eaters, their consumption on the average of up and down trips being well over 200 lb. per mile. On down trips only enough steam was required to work the vac-brake ejector, so the consumption on the up trip was in the region of 400 lb. per mile!

Other disadvantages of the Fairlie were:

The pivot centre was central with the motor bogie wheelbase which resulted in considerable bogie oscillation at speeds of 20 m.p.h.

The whole weight of coal and water was carried on the boiler frame, so that the pivots had to be made considerably heavier than in engines which carry supplies of coal and water direct on the bogie frames. Supplies, particularly of water, were very limited and the Burma Fairlies always ran with an auxiliary tender attached, which of course reduced the pay load.

In the double-boiler Fairlie the driver was on one side of the boiler and the fireman on the other.

The 0-6-6-0 Fairlies in Burma were succeeded by 0-6-6-0 Mallet compounds of 27,646 lb. T.E. These were very successful engines, particularly when later superheated. The solution of the problem of ghat working however came with the provision of 2-8-8-2 Garratt locomotives of 41,889 lb. T.E.

During the war 10 2-8-8-2 Beyer-Garratts were ordered by the War Dept and also an expanded version,

# POSTBAG

continued . . .

*Virginia-type of locomotive on Trans-Siberian Railway (see "Siberian loco")*



2-8-2—2-8-2 type, of the same tractive effort but with increased coal and water capacity.

The load of the original 2-8-8-2 Garratts on the 1 in 25 grade was 230 tons, only 10 tons less than two of the 0-6-6-0 Fairlies. Their coal consumption was round about 105 lb. per mile average of up and down trips.

It was certainly one of my most thrilling experiences to ride on the footplate of a Beyer-Garratt charging up the 1 in 25 at 12-16 m.p.h. with 230 tons of train trailing.

Lympington, Hants. E. V. M. POWELL.

## SHOCK FOR CHINK

SIR,—I wonder if J. A. Geddes [Postbag, December 27] could describe how static electricity was generated in the steam wagon I drove.

The tyres were solid rubber, the mudguards flat in section, and there was nothing electrical on the vehicle. I found it most pronounced when the wagon was stationary on a fine sunny day with the safety-valve just showing the "white feather" and the trailing chain not touching the ground.

A rather amusing incident occurred one day. It happened during the first world war at a large coal dump near Rouen where about 100 or more Chinese labourers were employed. I was having my lunch on the footplate, the Chinese were hanging about, and one came alongside trying to peer at the motion.

He gave a yelp, leapt back a yard, looked at me blankly, then said: "You fightee, fightee, fightee me!" and called something to the others, who all began to move towards me. Thinking discretion the better part of valour, I opened the regulator and chuffed out the yard.

Barnoldswick, JOHN T. BRYDEN.  
Lancs.

## SIBERIAN LOCO

SIR,—With regard to L.B.S.C.'s *Virginia* and the subsequent correspondence in Postbag concerning this type of locomotive, I recently discovered in a pre-war magazine, *Harmsworth's History of the World*, an illustration of a locomotive operating on the Trans-Siberian Railway.

The locomotive is complete with balloon-type, spark-arresting, smoke stack. The outside cylinders have overhead valve chests and the whole machine has a mixed British-American look about it.

Sale, Cheshire. P. W. TOMLINSON.

## THE STEAM LOCO

SIR,—May I assure Mr Woodcock [Postbag, December 27] that I claim no monopoly in arboreal ancestors, going further back our universal ancestry was probably an amorphous mass of protoplasm in the pre-historic sea.

Some time ago Mr Woodcock said that I regarded myself as an authority, which is untrue. May I suggest that Mr Woodcock himself is prone to indulge in the rather futile task of

attempting to teach his grandmother to suck eggs? My reasoning powers are sufficiently developed for me to work out for myself the rather obvious fact that the steam locomotive is a self-contained unit using home-produced fuel.

I would counter this by pointing out that we are now, at enormous cost, importing millions of tons of this same fuel. Taken to its logical conclusion, Mr Woodcock's argument would boil down to our importing nothing!

Surely it is possible to regret the passing of the steam locomotive (which anyhow does not affect model engineers or "builders of small locomotives") without trotting out a string of fatuous and futile abuse and unsound argument about its successors.

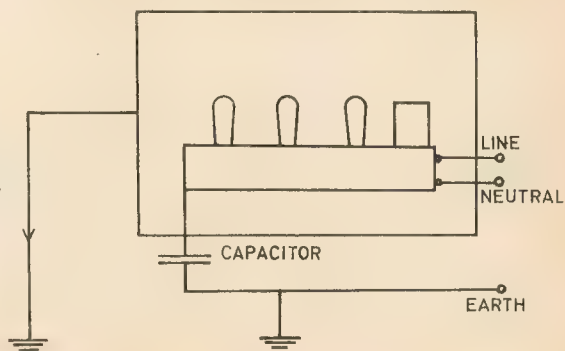
Rustington.  
W. Sussex.

K. N. HARRIS.

## JOGGING THE MEMORIES

SIR,—I have read with interest E. F. Carter's somewhat romantic article *Some Kent and East Sussex Memories* [MODEL ENGINEER, December 20].

*Principle of wiring a live radio chassis in earthed cabinet (see Mr W. Ford's letter in January 10 issue)*



I would enlighten him, however, regarding the water tower so described and shown in illustration No 2. This was erected as a temporary measure only towards the end of the last war to supplement the water supply for engines, if required, during the period of repairs to the Robertsbridge Junction main line water tank and services from which it was the normal practice for K. and E.S.R. engines at this end of the line to obtain water.

I do not wish to disappoint Mr Carter but I am afraid he would never have obtained a photograph of the eight-wheeled coupled tank engine *Hecate* quenching her thirst at the structure referred to as not only was the locomotive restricted from this section of the line on account of its axle loading being in excess of that permitted on the bridges but it had long since been disposed of to the Southern Railway for use at Nine Elms Yard.

I fail to understand why the double arm signal at Robertsbridge Crossing is referred to as a lampman's nightmare on a windy night as the lamps were lowered and raised to their normal positions from near ground level by means of windlass and chain with which this signal post was equipped.

Tonbridge, Kent. W. H. AUSTEN.

## CALLING AMERICA

SIR,—I wonder if you could put me in touch with an American reader of *MODEL ENGINEER* who would be willing to exchange photographs of old-time wood-burners and modern American steam-engines for photographs of English locomotives.

Cheltenham, Glos. M. J. FRENCH.

## N.E. "RACERS"

SIR,—I read J. N. Maskelyne's article on the North Eastern Railway "Racing Engines" [*MODEL ENGINEER*, December 27].

The very day I read it I was looking at some railway books and I came across a photograph of what I think was one of these engines. It was not coloured but I could follow the lining detail, described in the article, very easily.

It was very like the drawing but it had a slightly different smokestack and the number was 1621. In the article the numbers were given as 1869 and 1870. Could Mr Maskelyne explain this?

If this was the locomotive in question it may be of interest to note that it is preserved at York Museum.

Snodland, Kent. J. W. J. LARKIN.

● No 1621 belonged to an earlier

*class of engines, and became famous for her running during the races that took place between London and Aberdeen in 1888. For this reason she has been preserved. This class was originally built on the Worsdell-von Borries two-cylinder compound principle, but later converted to simple working.*—J.N.M.

## DELIGHTFUL TO USE

SIR,—Some years ago Johnson Matthey and Co. supplied me, to special order, some of their Easy-Flo in 0.03125 in. dia. wire for making up small boiler fittings for my locomotives. This is beautiful stuff, being much handier than 0.0625 in. wire for such purposes. [See *L.B.S.C., MODEL ENGINEER*, January 3, page 26.]

I am now using the last inch of my original supply and I note that Reeves and Co. of Birmingham are stocking Easy-Flo in this small diameter; naturally I am buying more. Bideford, Devon. J. DAVIES.

## BUILDING MODELS

SIR,—I have been a reader of *MODEL ENGINEER* since 1929 (excluding the war years 1939-1947) and I am very pleased to see a return to articles on the making of model steam engines, model ships and clocks. In particular, the series by C. B. Reeve on the M.E. Musical Clock is most interesting.

Recently it seemed to be a policy to include much space devoted to full-scale projects, past and present, and while it must be admitted that some of these were very interesting and no doubt responsible for stimulating model engineers to build such machines, I feel this can be overdone because such information is already available in trade and professional journals.

Articles, with dimensioned drawings, giving details of the construction of particular models are very popular. I look forward to one on the making of a flash-steam plant at some future date, and a series on brazing, welding, forging and heat treatment would be very valuable to those who do not always have a workshop equipped with machines.

Derby. G. L. WILDE.

## FUEL AND I.C. ENGINES

SIR,—If G. Woodcock [Postbag, December 27] knows i.c. engine history he should know that the basic idea behind the highly unsuccessful Diesel engine was only worthy of a tin-pot dictator, if it was not actually inspired by one.

It was intended to run on any indigenous fuel and the first one to fire actually blew itself to pieces operating on pulverised coal. Metal-

lurgical consideration dictated the use of the most inefficient cycle possible to enable a cold-starting engine to survive the high stresses involved, and the solid ash in the bore rapidly rendered the engine useless.

The air blast injection system which is a part of this engine can also function with liquid and gaseous fuels and it only survived commercially for a while in marine and power station work. The compression ignition engine was invented in this country by Robert Ackroyd Stewart and the only relic of Diesel today is in the high-compression ratios now used universally.

Mr Woodcock will insist on an indigenous fuel engine so let us list these: coal, coke, benzol, tar, tar-oil and alcohol. The liquids could be used in piston engines either by airless or airblast injection or by carburation with spark ignition. Pulverised fuels are out because you cannot control ash emission.

The ash slagging Cyclone furnace using crushed fuel can be used in a steam turbo-electric engine using high-pressure steam instead of the hot water used by the old fangled externally-entrained engines, with the closed circuit gas turbine. This latter unit has been developed in Canada for railway purposes. The open or closed circuit turbines can be designed, to use any of the liquid fuels.

I hope it will be possible for Edgar T. Westbury to give a series of articles explaining simply the five different heat cycles employed in i.c. prime movers.

London, E.6. A. E. CLAUSON.

## FACTS PLEASE

SIR,—One reads in the newspapers that there is a serious shortage of technicians. Judging from the pages of *MODEL ENGINEER* over the last 25 years there is one type that shows no shortage, namely the designer of steam cars. In marked contrast is the shortage of steam car builders.

One thing steam car enthusiasts have in common is a desire to convince everyone what a marvellous performance their products will have.

What these enthusiasts never tell is what number of miles per gallon one could expect with their chosen fuel, be it petrol, paraffin or oil. And be it noted that all these fuels carry a heavy tax so there is no question of offsetting a heavy fuel consumption by using a cheap type of oil.

If one is running a veteran steam car as such then one expects to pay for the fun, and fun it can be, no less than bringing a traction engine out on a Sunday afternoon.

Shipley, Yorks. FRANK D. WOODALL.

# READERS' QUERIES

Do not forget the query coupon  
on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

## Refitting a lathe

I have a lathe, the make of which is unknown. On close inspection I found that the slide was very slack when working close to the headstock (therefore, having to be adjusted) but on approaching the tailstock it becomes very tight and finally binds up.

A friend suggested that the lathe required regrinding, but I understand this is very expensive to do. I have considered mounting a fine file or honing stone in the slide and working it back and forth, thus removing the high spot, but I should appreciate your advice.—G.F.B., Tilbury, Essex.

▲ Your method of using a file or hone on the saddle or other slides is not recommended as there is no guarantee that this would produce the necessary accuracy. Any such method would produce waves or other errors, as the tendency is for it to follow initial inaccuracies rather than produce a true surface. It is assumed that the lathe has the conventional type of dovetail slide for the saddle and other slides and, in such cases, most of the wear would probably affect the angular surfaces as well as the flat top surface.

The most satisfactory method of refitting the lathe—apart from regrinding—would be by hand scraping, using an accurate surface plate of a length not less than the length of the bed for checking the accuracy of flat surfaces, and test bars of the correct angle for the dovetail slides for checking angular surfaces.

## Gears for screwcutting

I would like your advice on gears for screwcutting. My leadscrew is eight t.p.i. I have a 30, 32, 35, 38, 40, 45, 50, 55, two off 65, two off 20 and 60 gears. Can you tell me the best way to lay the foregoing out for normal B.S.F. and Whitworth threads? When I try I never seem to have a big enough gear.—W.M.H., Chelsfield, Kent.

▲ The gears specified should be adequate for cutting most standard B.S.F. and Whitworth threads, using a leadscrew having eight t.p.i. The method of setting up the gears, however, varies to some extent depending on the accommodation available on the change wheel quadrant, but most manufacturers issue a chart showing

the gear trains used on their particular lathes. Screwcutting charts for leadscrews of eight t.p.i. using the gears you have can be found in the Percival Marshall handbooks "Practical Lessons in Metal Turning" (price 6s.) and the "M.E. Lathe Manual" (price 12s. 6d.).

## Piston projects

I am constructing the DOLPHIN 10 c.c. o.h.v. petrol engine and have been working from articles published in MODEL ENGINEER. On assembly I find that at t.d.c. the piston projects  $\frac{1}{16}$  in. above the top of the liner flange, with components machined as drawing. Could you tell me where the fault is, and if a  $\frac{1}{16}$  in. packing piece at the base of the cylinder barrel would be permissible to rectify matters?—W.H.C., Birmingham.

▲ It is quite in order for the piston to project  $\frac{1}{16}$  in. above the liner flange. This is common practice with many types of engines, the idea being to minimise as far as possible the formation of a ridge in the cylinder bore at the top of the stroke.

If you wish to reduce the compression ratio a  $\frac{1}{16}$  in. packing piece at the base of the cylinder could be used, but otherwise you will not find it necessary.

## Aluminium tube

I am thinking of using some aluminium tube instead of brass or copper for the stern tube of a model cargo boat I am building. Do you think the grease with which it will be filled to keep it water-tight (I use Vaseline) will have any corrosive effect on the aluminium?—L.B., Derby.

▲ Aluminium tube will be perfectly satisfactory and will probably give just as good results as brass. Copper is an unsuitable metal for a stern tube if the shaft takes a direct bearing in it, though it could be bushed with a suitable bearing metal. Vaseline will not have any corrosive effect on aluminium, but this is not very effective as a lubricant and its main function is as a protective grease.

## Plans of merchant ships

I am interested in making scale models of merchant ships. Most of my models have been made to a scale of approximately  $\frac{1}{8}$ -1/6 in. to the foot and I have used the plans of

ships on which I have served. But I am having great difficulty in obtaining plans for new models as most firms do not seem to publish plans to the scale I require.—P.N., London.

▲ Most shipbuilding papers publish useful plans of merchant ships which would give you practically all you need for making your models. These plans are published to a rather small scale, but it is quite easy to use them as they are. The method is to draw a grid of horizontal and vertical lines in pencil over the reproduction, spacing them so that the space represents 1 in. on the model. For example, if you want to make your model three or four times the size of the reproduction the lines of the grid should be spaced at  $\frac{1}{3}$  or  $\frac{1}{4}$  in. apart so that in working you consider these small squares as being 1 in. and measure your work accordingly.

## Power for lathe

Could you tell me if a  $\frac{1}{2}$  h.p. motor is sufficiently powerful to drive a Super Adept 1 $\frac{1}{2}$  in. lathe, and, if so, what pulleys and belting would I need to turn small wood and metal parts for model sailing ships  $\frac{1}{2}$  in. = 1 ft scale—brass cannon, belaying pins, stanchions, etc.?

Could you also advise me at what speeds it ought to be run for metal and wood turning?—D.S.F., Keswick, Cumberland.

▲ A  $\frac{1}{2}$  h.p. motor should give quite adequate power for driving this lathe. It is usual to drive small metal working lathes at a maximum speed of up to about 1,000 r.p.m. and this would require the fitting of a countershaft between the motor and lathe to get the necessary speed reduction. For light work such as you suggest, however, and excluding the turning of castings which require relatively low speeds, it would be possible to dispense with the countershaft and fit a stepped pulley, the counterpart of that on the lathe mandrel but with the steps in the reverse order on the motor shaft. This would give a maximum speed up to approximately 2,000 r.p.m., which would be very satisfactory for small metal and wood turning, but the lathe referred to is not really intended to work at such high speeds and mandrel lubrication would have to be carefully watched.

# ★ ★ ★ CLUB NEWS ★ ★ ★

Edited by THE CLUBMAN

**W**HILE other societies are talking of a possible increase in subscriptions as one of the prospects for 1957, Birmingham S.M.E. has already taken action. From New Year's Day its members are paying double the previous fee.

For the veterans over 65 and the juniors under 21 the subscription remains as before: a guinea or half a guinea, according to whether the subscriber is an "ordinary" member or a "country" one. In this way the society is doing what it can to help those with small or fixed incomes.

## A special meeting

The decision to double the subscription was taken at a special general meeting on finance. In the past few years the society has failed to balance income and expenditure, and in the future—even assuming that it wins its rating appeal—a big increase in rates must be expected. "The outlook," writes P.R.O. W. Finch, "is not bright."

After much discussion, the meeting at Campbell Green therefore agreed by a heavy majority that if the society were to keep all its amenities it had no alternative but to increase the subscription of ordinary members from a guinea to two guineas and of country members from half-a-guinea to a guinea—with the exception of the veterans and juniors.

"It is sincerely hoped," adds Mr Finch, "that all members will appreciate the purpose of the increases, which are inevitable. Even at the new levels they are full value for the amenities available and compare very favourably with our subscription rates in the past."

"It would be interesting to know what other societies are doing to meet the new rating difficulties. We commend the idea of helping the junior members and over 65s to other societies who may be contemplating increasing their subscription rates."

## STILL CHEAP

Undoubtedly the decisions taken at Campbell Green will be studied with great interest by clubs throughout the United Kingdom. They may also influence other decisions, especially at forthcoming annual meetings. As for the clubs and their rates—this subject was aired months ago in a MODEL ENGINEER article and so far there has been very little response.

Whatever increases are made the membership of any really active modelling club brings with it privileges which must still be accounted ridiculously cheap. I am sure that if any reader of this page decides to join the 20,000 emigrating weekly to Canada he will not be leaving on account of his club subscription!

At 1.38d. a day Birmingham S.M.E. will still be giving excellent value.

Interesting meetings held recently include a television broadcast when the society (or so it believes) was the first to erect a portable track inside a B.B.C. television studio. Members also enjoyed a trip over the Liverpool Overhead Railway before it closed, alas, for ever, and a visit to Aston Motive Power Depot.

Lectures and other occasions are planned for the next three months, but outdoor events and meetings during the summer will not be fixed until the prospects for petrol become more hopeful. The petrol shortage, if it continues for long, is likely to affect the summer programmes of many clubs this year, and even the staunchest admirers of live steam are unable to chuckle.

## THEIR OWN SANTA CLAUS

In the United States money is less of a bother. Members of an American club, for instance, may visit another club by air.

Even so, making full allowance for the gold in Fort Knox, the Golden Gate Live Steamers seem to be doing extraordinarily well. Santa Claus beams prosperously from the front page of their December issue of *The Callboy*, and when I read in the president's message on the second page that the club's gain in material assets during the year "is estimated at about five dollars for every dollar of club funds spent" I began to wonder just what the old gentleman had been up to in Oakland, Cal.

But in fact the Live Steamers are their own Santa Claus. If they make the equivalent of 35s. from every seven shillings subscribed, the explanation, says the president, lies in the enormous amount of work done by the members and also in the acquisition by them of some material.

"In our club," continues president Art Stewart, "this is normal, but some of our hard-working members deserve a special tribute for their efforts.

With no intention of minimising the efforts of any member, I do not hesitate to point with special thanks to men like Bill Brower, Louis Lawrence, Bob Byers and several others who work constantly to make the facilities better for us all to enjoy. I hope we all appreciate the work done by John Sweet to get the coal. Our hard-working editor, Larry Duggan, and publisher Floyd Epperson, have my thanks for a splendid job.

"More people are enjoying the club than ever before, and the trend is upward."

## M.E. DIARY

**January 24.**—South London Ship Model Society, talk by H. Beesley.

**January 25.**—Merseyside Branch, World Ship Society, "St Lawrence Seaway," George Musk (C.P.R. historian), 7.30 p.m. J.I.E., Pepys House, "Fire Fighting Equipment," Edmund S. Calvert, 7 p.m. Welling and District M. and E.E.S., "Materials for Locos" (discussion).

**January 28.**—Clyde S. and M.M.S., model making; discussion, Highlanders' Institute, Glasgow.

**January 30.**—Birmingham S.M.E. Bits and Pieces, White Horse.

**January 31.**—Hull S.M.E. "Transport Development," G. Shepherdson.

**February 7.**—Hitchin and District M.E.C., films. Eltham and District L.S., "Boiler Brazing," chairman A. L. Hutton. Institution of Mechanical Engineers, "The Place of Engineering in University Education," Sir Ifor Evans (Graham Clark Lecture), headquarters, 5.30 p.m.

**February 12.**—Bristol Ship Model Club, Legion House, Portland Square, 7 p.m. "Medieval Ships," N. H. Poole. Non-members welcome to all meetings.

# Model Engineer

Classified Advertisements together with advertisements should be sent to Model Engineer, 19-20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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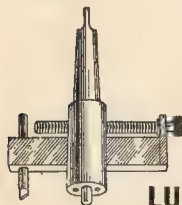
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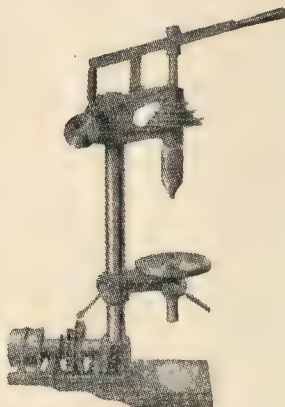
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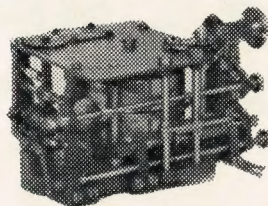
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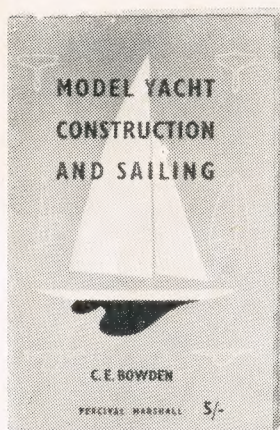
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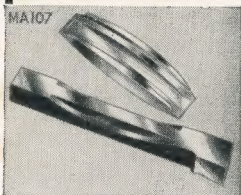
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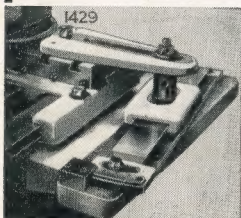
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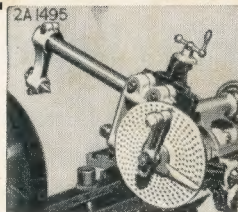
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